CEMBER 25, 1961
Volume 50, No. 26

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OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

AMERICAN DYESTUFF REPORTER

TEXTILE WET-PROCESSING

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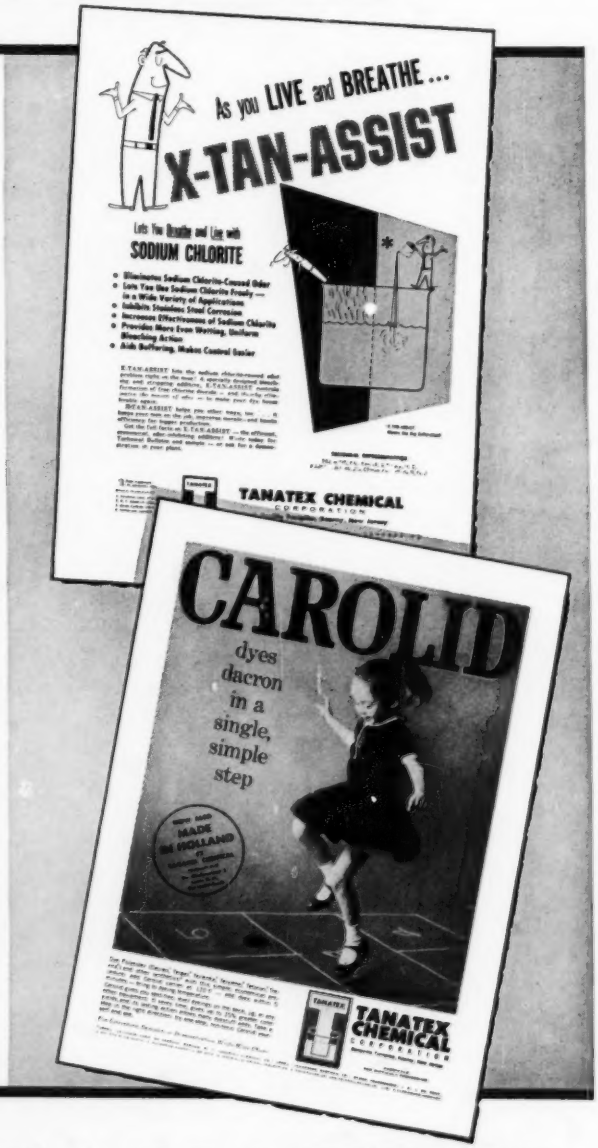

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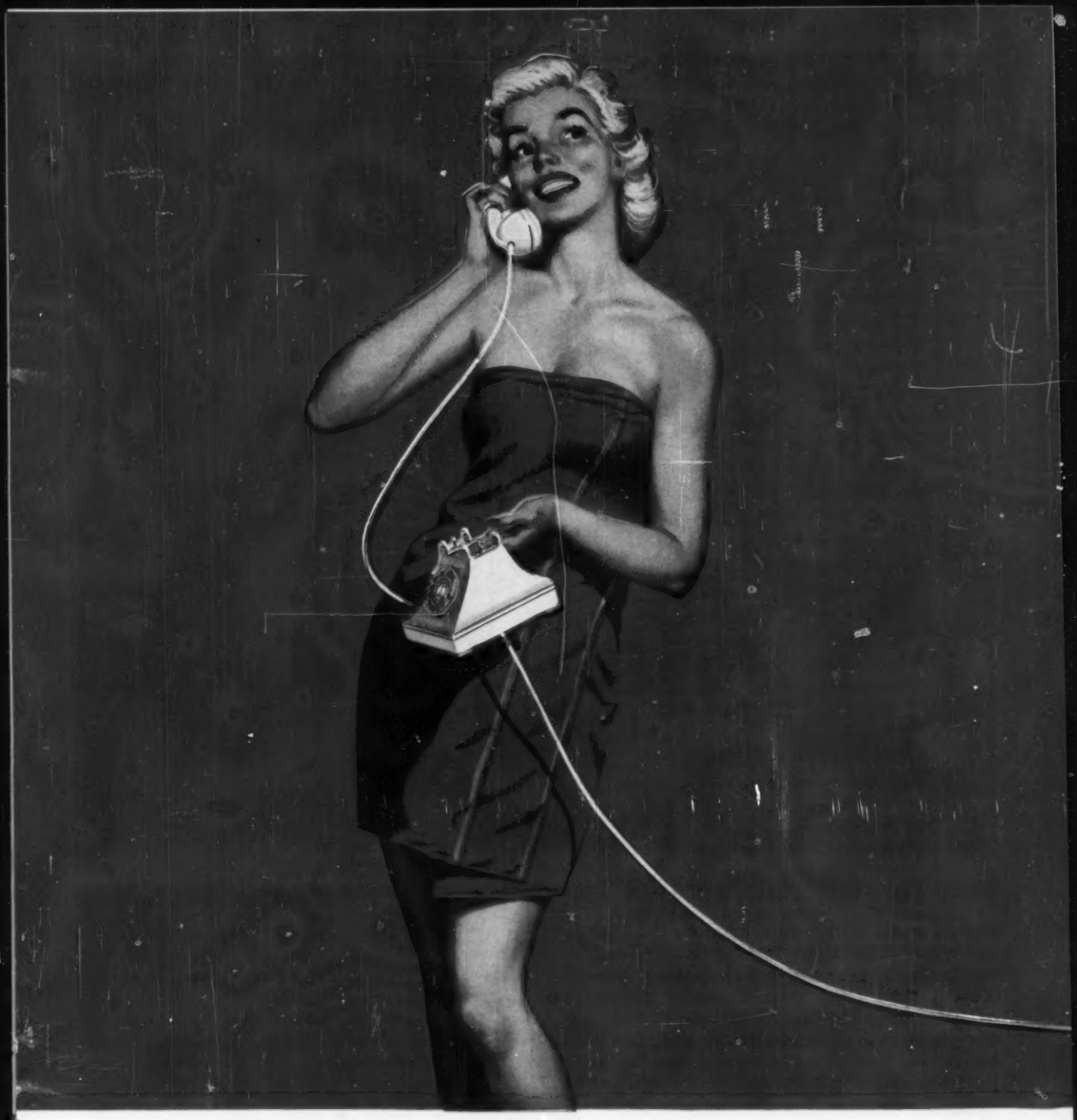

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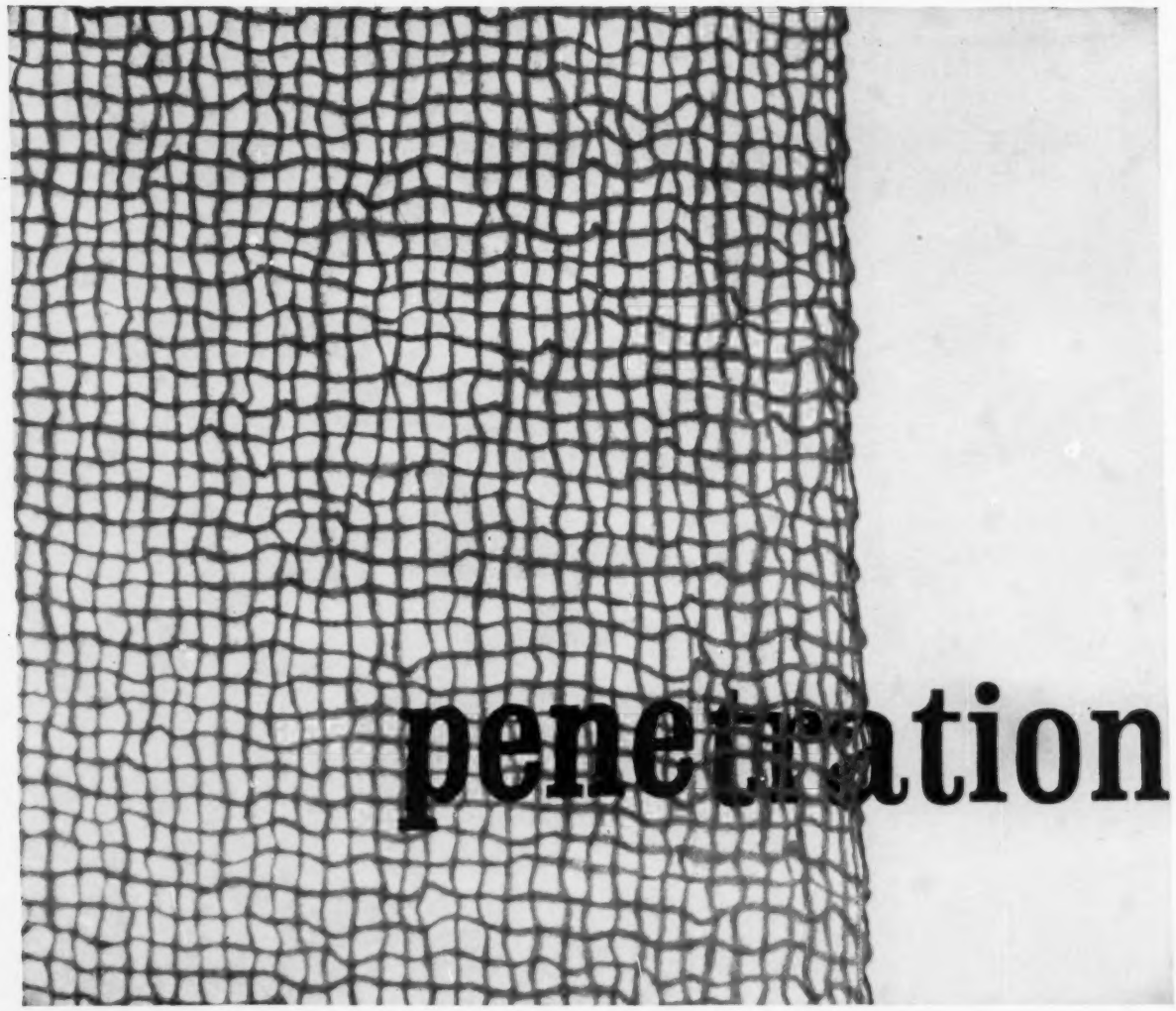

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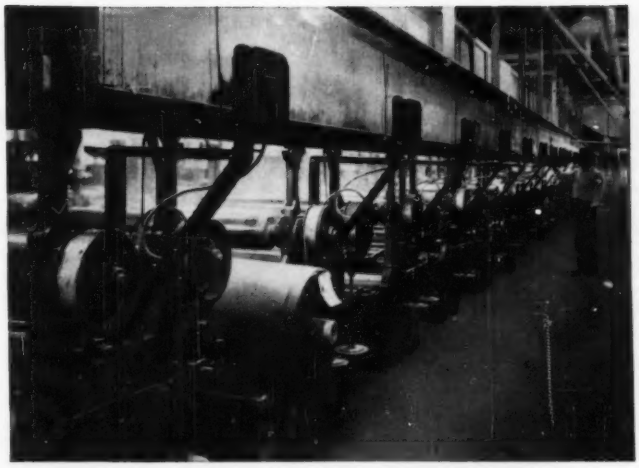
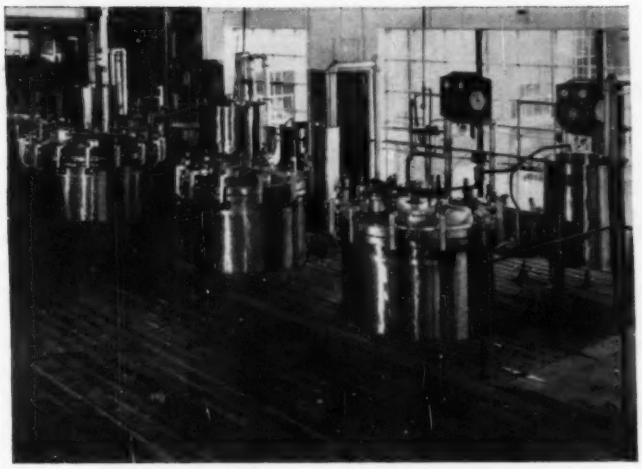
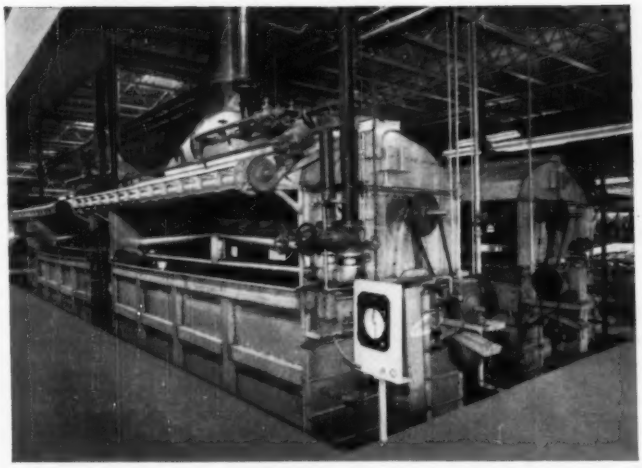


Dye Jig Operation



Package Dyeing



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one of a series in which we present some facts and express some opinions to help textile chemists solve dyeing and finishing problems

The Subject of the Month

The Case of the Tarry Specks

A careful analysis of dyeing procedures unearthed clues that helped solve a mysterious dyeing problem

A well-known dye works in Northern New Jersey recently ran a large volume of triacetate/cotton fabric in a royal blue shade. The dyer had chosen to dye the fabric in a single bath containing both the direct and the acetate dyes. When the lot was on-shade, it was given a simple hot water rinse and fixed while still in the dye box.

Spots Before Their Eyes

In about one out of three lots, specks appeared on the fabric during drying. Both the head finisher and the dyer concluded that one of the acetate dyes, Eastman Blue GP, was tarring out—that large particles of the dye were clinging to the material and, during the heat of finishing, were decomposing. Following this line of reasoning, the dyer switched to another manufacturer's blue. First lot looked fine. Second lot—specks!

At this point, the dyer decided he needed help and called in an Eastman Technical Representative.

Was the Acetate Dye Responsible?

Within the hour, an Eastman man was on the scene following a lot through the complete dyeing and finishing operation. Nowhere in the dyeing process itself was there any evidence of specking. Only after the fabric had gone through the finishing range could the specks be detected. And the man from Eastman reluctantly agreed that they certainly looked like tarred dye formations.

Then, acting on a hunch, the Eastman representative took a piece of the finished fabric and treated it in an acid bath. *The specks disappeared.* This indicated the problem was not caused by undispersed acetate dye, since the acid treatment would not then have cleared the fabric so readily.

Clues Point to the Culprit

On the other hand, the Eastman representative knew that the chemical bond between some fixatives and direct dyes can be broken under acidic conditions, thus implicating those components as the probable source of the specking problem.

In order to pinpoint the problem, however, another dyeing run was begun. Eastman Blue GP was again used but the procedure was changed to include a thorough rinse in a hot salt solution immediately after dyeing. This time *no specks appeared* after the finishing.

Salt Bath Did the Trick

During a more detailed study of the problem, it was found that the fabric underwent considerable fibrillation during the rinsing cycle. The direct dye that bled into the rinse water combined with the fixative when the latter was added to the bath. The reaction of fixative and dye produced a residue, some of which was picked up by the bits of fiber. These particles, being the same color as the fabric itself, were not distinguishable as they clung to the fabric's surface. But when the fabric went through the finishing range, the heat caused the gummy residue to decompose, leaving tarry specks visible.

The presence of salt in the bath stopped the direct dyes from bleeding into the rinse and therefore prevented the formation of dye residue. No dye residue—no pick-up. No pick-up—no specks.

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American Dyestuff Reporter was founded in 1917 and the Textile Colorist was incorporated with it in January, 1949. Published every other Monday, by the HOWES PUBLISHING COMPANY, INC, 44 East 23rd Street, New York 10, NY. C R Howes, president; Ernest J Finan, executive vice president; Norman A Johnson, vice president & treasurer; Myron D Reeser, vice president; Clara Patrick, secretary.

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VOLUME 50 December 25, 1961 NUMBER 26

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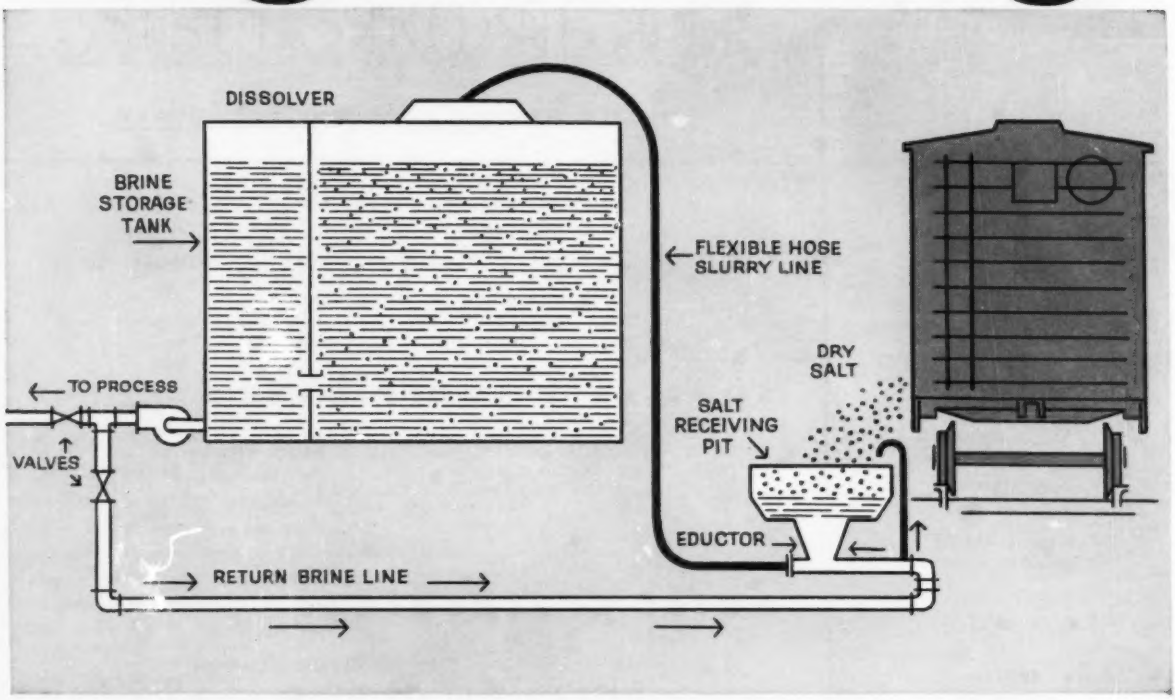
salt engineering



New hydraulic salt-handling system pays for itself in one year

A food-specialties manufacturer used to buy evaporated salt in bags. They used a batch mixing process to combine the salt with other ingredients to produce a patented product. Lugging the salt from boxcar to the plant, storing it, then dumping into mixing vats was time-consuming, expensive and took up valuable warehouse space.

In an effort to speed up and economize on the operation, this manufacturer called in an International Salt Company Technical Service Representative. He recommended simplifying the mixing process by installing a Storage Brinomat* Dissolver outside the plant. The Dissolver automatically supplies sparkling, pure brine to the process *continuously*.

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ADR OPEN FORUM

(A page devoted to reader comments, general comments by the staff of *American Dyestuff Reporter*, and "letters to the editor". Names of those submitting material for this page will be withheld on request. Address letters to "Open Forum," American Dyestuff Reporter, 44 East 23rd St, New York 10, NY).

December 25, 1961

A CAROL FOR ALL PEOPLE

AT the end of another year, we take this opportunity to offer all our readers and friends best wishes for the holiday season and a happy and prosperous New Year.

And with our overseas and domestic circulation continuing to grow, we offer what we think to be a most appropriate "Carol for All People", courtesy of Marsh Steiding:

"'Tis the season to contemplate goodness and right,
To submit to the will of the heavenly light,
To resolve to be steadfast and loving and strong,
Thus, to rid the good earth of its manifold wrong.

"As we keep our great festivals throughout the earth,
Let us join in their spirit and share in their mirth,
May they give us renewed affirmation of life,
That will hasten the end of all hunger and strife.

"Let's rejoice and be glad for the feast of the lights,
For the babe in the manger, the colorful nights,
But we know truest joy comes from sharing our bread,
That the earth's hungry children be cared for and fed."

* * *

"IT seems to me there is a great deal of nonsense on both sides in this problem of the relation of science to the humanities. We should emphasize the similarities between the essential methods of science and the essential activities of the people who work in the humanities. Without imagination there could be no science. The intuitive power of the mind in dreaming dreams is the essential basis for the advance of science. I think this has been shown in the great physical theories of our time: the theory of relativity, the quantum theory, and to a certain extent also in the theories of biology. Here we can see the similarity between the actions of the humanist who works with intuition or imagination and the creativeness of science. The creation of a scientific theory, to my mind, is ultimately just as much a work of art as the painting of a great picture or the composition of a piece of music. It represents exactly the same kind of mental activity."———Lindsay. An excerpt from *"Science and the Humanities"* in the book, *"Education in the Age of Science."*

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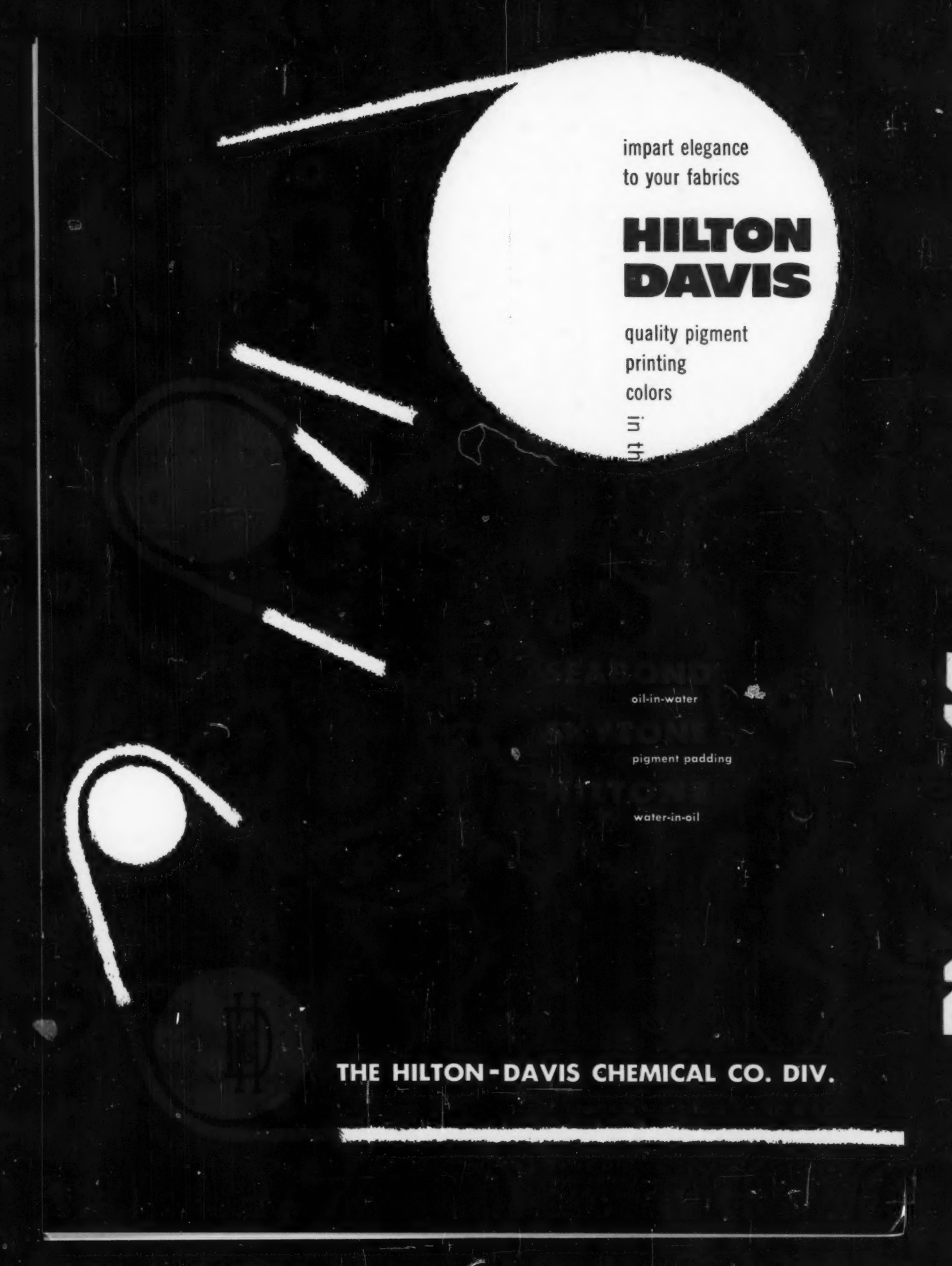
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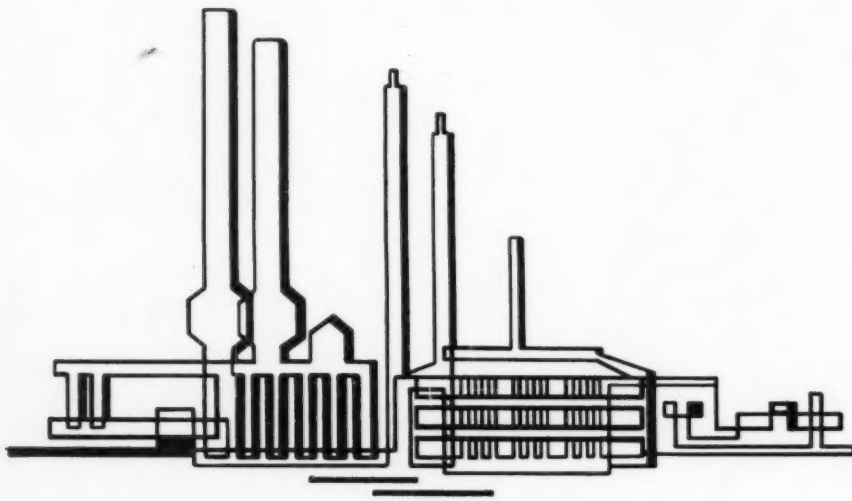

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REACTIVE ACRYLICS - A NEW TYPE OF TEXTILE FINISHING MATERIAL*

A C NUESSLE and B B KINE

Rohm & Haas Co

Philadelphia, Pa

MENTION of the word "acrylics" creates different images in the minds of different people.

Many persons will think of Plexiglas, the sheet acrylic used for skylights, window panes, advertising displays, jewelry cases, and canopies for military airplanes. Others may think of acrylic molding powder, the varied applications of which range from red taillight lenses for automobiles to fillings for teeth.

To those who work in the textile industry, the term "acrylics" is more likely to conjure up visions of white, milky, aqueous dispersions, or so-called emulsion polymers, exemplified by the Rhoplex and Primal resins. This is the form in which acrylics are most often applied to textiles for such diverse uses as bodying and stiffening, "wash-wear" finishing, rug and upholstery backing, pigment binding, and nonwoven bonding.

On the other hand, persons who are engaged in textile coating operations may be more familiar with the clear but viscous solvent solutions known by the tradename Acryloid.

The word "acrylics" covers all of these—and more. There are, for example, emulsion polymers that become viscous colloidal solutions on addition of alkali; these are variously used as thickeners or warp sizes. Others, more rare, become colloidal solutions on addition of acid. Moreover, certain emulsion polymers may be transformed directly into solvent solutions by addition of isopropanol.

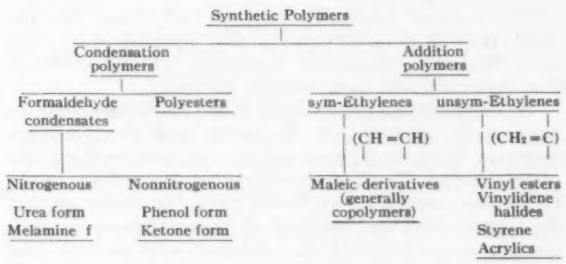
For the dry bonding of nonwoven fabrics, there are tiny acrylic beads, a few thousandths of an inch in diameter, that may be sifted into the fiber web and fused by heat.

From these examples, it should be apparent that acrylic resins come in a variety of forms and have a diversity of uses. But during the past few years still another dimension has been added—certain acrylic polymers now contain functional groups that permit them to react with themselves or with other chemical molecules during application to the fabric.

The main purpose of the present paper is to discuss the properties and uses of these new reactive polymers. However, for the sake of completeness, the discussion will begin on a broader scale, with a review of the properties of acrylic polymers in general.

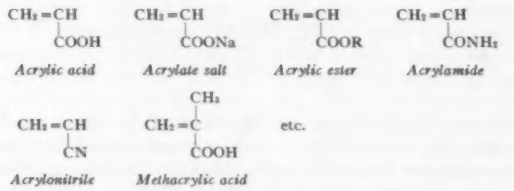
SOME GENERAL PROPERTIES OF ACRYLICS

The following chart shows, in a simplified form, the chemical relationship between the acrylic resins and other synthetic resins commonly used in textile treatments:

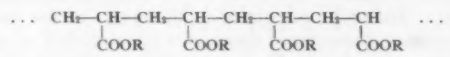


It will be noted that the acrylics are a subdivision of the unsymmetrically substituted ethylene class, which is composed of resins obtained by polymerization of monomers containing a $CH_2=C<$ group. It is not unexpected, therefore, that in properties and uses, the ordinary acrylic resins are more closely related to vinyl polymers such as polystyrene or polyvinyl acetate than to the condensation resins such as the urea-formaldehydes.

More specifically, the acrylic monomers include acrylic and methacrylic acids and their salts, esters, amides, and nitriles:



Any of these, alone or in combination, will undergo addition polymerization to form a linear polymer thousands of units long:



In certain instances, acrylic *monomers* may be applied directly to textiles, but more often the *polymer* is employed. The application is ordinarily made in one of three ways:

a) *From water solution:* the water-soluble polymers include polyacrylic and polymethacrylic acids, their alkali and ammonium salts and their amides. Acryonitrile and the acrylic esters cannot be so applied, unless copolymerized with a substantial proportion of one of the water-soluble acrylics. Applied to textile yarns or fabrics, such materials usually

*Presented by Mr Nuessle at the Technical Meeting of the CATCC at McGill University on Oct 21, 1961. This article appeared also in *Canadian Textile Journal 78*, No. 24, 41-51 (Nov 24, 1961).

remain water-soluble unless steps are taken to insolubilize them. Typical products include thickeners and warp sizes.

b) *From solvent solution*: the acrylic esters and their copolymers with acrylonitrile may generally be applied from solution in ethylene dichloride or other suitable solvent. A typical end use is a fabric coating.

c) *From aqueous dispersion:* the water-insoluble monomers may be polymerized in emulsion form, to produce an aqueous dispersion or latex. Properly made, such dispersions are stable in storage for a year or more, and may be readily diluted with water to any degree at time of use. Because of the ease of application, this is the most popular method of applying the water-insoluble acrylics to textiles for a wide variety of uses.

The present discussion will be concerned for the most part with polymers in the aqueous dispersion form, although occasional reference will be made to the water-soluble and solvent forms.

The aqueous dispersions are made by emulsifying an appropriate mixture of monomers and then copolymerizing them through means that are outside the scope of this paper. The resulting product is a white, milky dispersion containing tiny solid particles; depending on the composition and method of preparation these will usually range from 0.1 to 1 micron in diameter. The molecular weight of the polymer is very high, ranging from 100,000 to 5,000,000 or more. The product will usually be quite fluid despite the solids content of around 50%.

From the chemical standpoint, the polymer backbone will in most cases consist primarily of acrylic esters such as ethyl acrylate or ethyl methacrylate. The exact choice of monomers to make up the polymer backbone is dictated by a number of considerations, one of the first of which is polymer hardness. The more common acrylic esters vary as follows with respect to the degree of hardness of their polymers:

Hardest:	methyl methacrylate	(MMA)
	ethyl "	(EMA)
	n-butyl "	(BMA)
	methyl acrylate	(MA)
	ethyl "	(EA)
	n-butyl "	(BA)
Softest:	2-ethylhexyl acrylate	(EHA)

Intermediate effects can be achieved through copolymerization, and MMA is widely used to add hardness or toughness to copolymers. Similar hardening effects can be obtained with acrylonitrile, styrene, vinyl chloride, or vinyl acetate. The last three are not acrylics, but through appropriate techniques they can readily be copolymerized with acrylics.

Polymer hardness is important primarily because of its effect on fabric stiffness. Generally, the harder the polymer, the stiffer the fabric. However, in the case of the aqueous dispersions there is a limiting factor: if the polymer is too hard, the tiny particles will not fuse on drying and no continuous film will form. Therefore, the fibers will not be bonded together but merely covered with powdery polymer. As a result, the fabric will remain relatively soft and will have a "delustered" appearance. Certain textile delustering agents are based on this principle.

These effects are illustrated by the data in Table I, abstracted from an earlier publication (*10*).

It might be mentioned in passing that there is no similar stiffness limit in the case of solution polymers; all form continuous films regardless of monomer content. Thus, a solvent solution of poly MMA will dry down to a very hard film and will impart a very stiff hand to fabric. Polymers in water solution also form continuous films.

TABLE I

Emulsion polymer composition vs film and fabric properties

Polymer composition	*Film form*	*Properties of fabric (4% applied solids) Stiffness (Gurley, mg/inch)*	*Hand*
Water Control	—	7	Soft
Poly EA	Soft, rubbery	10	Full
Poly (EA/MMA, 1 to 1)	Hard, brittle	31	Stiff
Poly MMA	Discontinuous, powdery	10	V al stiff, "delustered"

Returning to aqueous dispersions: the upper stiffness limit can be raised somewhat by use of higher drying temperatures, by addition of a small amount of high-boiling organic solvent or, by copolymerizing with a hydroplastic ("made plastic by water") material such as vinyl acetate. All of these encourage fusion of the tiny polymer particles into a continuous film.

In most instances a desired level of stiffness can be reached in several ways. For example, if poly methyl acrylate (MA) is satisfactory in a certain instance, the same level of stiffness can also be achieved by copolymerizing suitable proportions of EA, BA, or EHA (below MA in the hardness scale) with BMA, EMA, MMA, acrylonitrile, styrene, vinyl chloride, or vinyl acetate (which are above it).

Where the desired stiffness can thus be reached in a number of ways, the final choice is made on the basis of other factors— cost, adhesion, solvent resistance, lightfastness, to mention only a few. Each monomer has its own characteristics and idiosyncracies which cause it to vary in some respects from other monomers.

However, we shall not be further concerned with the monomers making up the main bulk of the polymer. Such differences, though often very important, are not pertinent to the present discussion. Rather, we shall concern ourselves with what might be called *functional* monomers; these are added in relatively small amounts to provide a marked change in physical or chemical properties.

Many such functional monomers have been studied, and much is known concerning their effect on a variety of polymer properties. As a case in point, let us consider methacrylic acid.

A polymer composed entirely of methacrylic acid will be water soluble. Copolymers with acrylic esters—as for example EA and MMA—are insoluble, and can be prepared in typical emulsion form. Now if the concentration of methacrylic acid is sufficiently high (at least 15 to 30%) then on addition of alkali (such as sodium or ammonium hydroxide) the polymer will be transformed into a colloidal solution. Because of the high molecular weight the solution will be quite viscous. Such materials are used as thickening agents (*3*).

With smaller amounts of acid (2 to 10%) the polymer will not be soluble, but will nevertheless thicken up on the addition of alkali. The effect is probably due to swelling of the polymer particles. This self-thickening property is useful in applications where a separate thickener is not desired.

Small amounts of methacrylic acid also improve mechanical stability of the emulsion polymer, and in some cases will provide freeze-thaw resistance. Moreover, a film of the polymer, laid down on a substrate such as paper, will usually have greater dry adhesion and increased oil resistance.

Finally, the acid groups permit both ionic and covalent crosslinking. Ionic crosslinking, as for example

by addition of aluminum acetate or zinc oxide, will impart solvent resistance and, in the case of the softer polymers, tend to reduce the tack. Covalent crosslinking, through means that will be discussed in a later section, will impart both wash- and drycleanfastness.

It is this latter property—the improvement in durability to be achived through the incorporation of reactive monomers into the polymer—that is our primary concern at present.

THE NEED FOR CROSSLINKING

It may well be asked why it is necessary to have such functional groups in order to obtain greater durability. After all, if an aqueous dispersion of small insoluble polymer particles is dried down and fused into a film, the dispersion will in most cases be irreversibly broken. The polymer will be insoluble not only in water, but also in hot alkaline wash liquor. What more is required?

There are at least two answers to this question. First, the polymer may still be soluble in solvents. While ordinary drycleaning solvents may not actually dissolve the polymer, they may nevertheless swell it to the point where it can be removed from the fabric by mechanical action. Since we are dealing with organic polymers, such an effect is the rule rather than the exception. Crosslinking not only makes the polymer insoluble, but reduces its tendency to swell.

The second reason for crosslinking involves a paradox: a polymer may apparently be resistant to laundering, as measured by retention of weight—that is, it will remain in the fabric—yet in certain applications, as for example in pigment dyeing or printing, much of the pigment will be washed out if the polymeric binder is not crosslinked. Similar loss of adhesion will be evidenced when an uncrosslinked polymer is used for upholstery backing or for bonding of nonwovens; in these cases the fibers pull loose from the binder during scrubbing or laundering (*9*).

The relative fastness of crosslinked versus uncrosslinked polymers in a nonwoven application is illustrated in Table I, where an all-viscose web was bonded at the 25% solids level with the two types of polymers.

TABLE II

Fastness tests on nonwovens bonded with acrylics

Test	*Uncrosslinked polymer (AC-33)*	*Crosslinked polymer (B-15)*
140°F Launder-Ometer wash	partly disintegrated	unchanged
Full Sanforized wash	disintegrated	slightly pilled
Perchloroethylene*	disintegrated	unchanged
Stoddard solvent*	unchanged	unchanged

*Charged system containing drycleaning soap and a trace of water.

The effect is all the more remarkable when we realize that the uncrosslinked polymer was Rhoplex AC-33, which is widely known for its outstanding resistance as a paint vehicle for both indoor and outdoor use. Its durability to weathering is excellent; yet as a binder for textiles to be subjected to hot alkaline tumbling conditions or to certain drycleaning solvents, it is unsatisfactory.

The improvement in binding properties through crosslinking is believed to be due in large part to the three-dimensional network that is set up. In pigment binding, for example, the pigment particles are enmeshed in the binder, which by virtue of its crosslinking is resistant to swelling and distortion. There is no need to postulate chemical bonds between the pigment particles and the binder, especially since effective bonding can be obtained with relatively inert pigments such as barium sulfate and carbon black. Similarly, in upholstery backing and nonwoven bonding the wet adhesion is to considerable extent mechanical in nature.

There are cases where covalent bonds between the reactive acrylic and the fibrous substrate have been postulated, but clear-cut evidence is lacking. If a reactive acrylic is baked onto a sheet of uncoated cellophane, the polymer film can usually be separated from the cellophane by prolonged soaking in cold water. This would not be possible if there were actual covalent chemical combination.

A third reason for crosslinking is increased resilience. Acrylics are rarely as springy as rubber; their recovery is somewhat slower. But crosslinking tends to increase the speed of recovery and considerably reduces the amount of creep.

Actually, the improvement in washfastness that results from crosslinking may be due, in large part, to the reduction of creep in the wet state.

THE CHEMISTRY OF CROSSLINKING

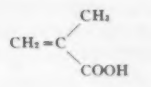
Literally scores of reactive monomers have been studied in a variety of end uses, and many of them have been disclosed in the patent literature (*4, 16, 18-23*).

From the examples cited below, it will be obvious that the reactive monomer need not necessarily be a member of the acrylic family; all that is required is that it be copolymerizable with acrylics.

In the usual case, the reactive groups will be located more or less randomly along the copolymer chain, though the distribution is sometimes difficult to control and even more difficult to measure. In any event, the resulting polymers will comprise a long chain of essentially inert monomer units interspersed with reactive units. In end use, as the polymer particles sinter together during drying to form a film, the reactive groups will crosslink adjacent polymer chains to produce a three-dimensional network.

From the chemical standpoint, crosslinking reactions are usually rather easy to understand, as in most cases they follow the principles of elementary organic chemistry. Moreover, since we are dealing with man-made polymers, we will of course know in advance how the crosslinking groups, which we have purposely added, should react. But there are instances when a certain monomer has been added for some other purpose, and its crosslinking tendencies discovered afterwards, quite by accident. As a result, there are some monomers whose mode of action is not clearly understood. This will be evident from the discussion below, which describes some of the practical and theoretical aspects of several types of reactive monomers.

CARBOXYLIC———As we noted earlier, monomers containing carboxyl groups permit *ionic* as well as *covalent* crosslinking. Both techniques have been used in the bonding of nonwoven fabrics; thus U S Pat 2,754,280 discloses copolymers of acrylic (CH_2=$CH.CO$-OH), methacrylic



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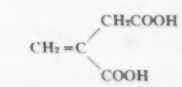


acids, crosslinked with polyvalent metals such as bar-

ium, calcium, and aluminum. Covalent crosslinking of such copolymers is covered in U S Pat 2,931,749.

The chemistry of ionic crosslinking is relatively straightforward. Polyvalent metal oxides, hydroxides, basic salts, or salts of weak acids are customarily employed; a typical example is basic aluminum acetate. The metal salt may be added to the emulsion at any time prior to use, though in some instances it has been found advantageous to prepare the mixture 24 to 48 hours in advance, as the crosslinking is thereby enhanced. This delayed effect is presumably due to more complete diffusion of the aluminum salt into the discrete particles of polymer.

In any case, maximum crosslinking does not take place until most of the water is removed during drying, at which time the metal ions link together nearby carboxyls to form a three-dimensional network, as shown schematically in Figure 1. As a result, the polymer is made resistant to drycleaning solvents, though washfastness is not improved and may actually be reduced.

The polymer is also less tacky. Metal oxides such as ZnO are especially effective in reducing tack.

Covalent crosslinking of carboxyl-containing polymers is somewhat more complicated from a theoretical point of view, though just as easy to accomplish. Best results, from the standpoint of wash- and drycleanfastness, are obtained through the use of a supplementary crosslinker such as urea- or melamine-formaldehyde or an epoxide, plus an acid catalyst. The treated textile should be dried and cured as in the application of any ordinary thermosetting resin.

The reaction seems to be one of esterification:

$$\text{(Polymer)COOH} + \text{HOCH}_2\text{(Resin)CH}_2\text{OH} + \text{HOOC(Polymer)} \longrightarrow \text{(Polymer)COOCH}_2\text{(Resin)CH}_2\text{OOC(Polymer)}$$

The resulting finish is quite durable, much more so than if the polymer had been composed entirely of acrylic esters. The latter will sometimes show a slight improvement in washfastness on addition of a supplementary crosslinker, but this may be due primarily to the fact that a small amount of carboxyl has been produced by hydrolysis of the acrylic ester during manufacture or storage.

Carboxylic polymers also tend to cure with heat alone, in the absence of catalyst or supplementary crosslinker. The mechanism is not well understood, but does not seem to involve anhydride formation since a) some carboxylic acids are much more efficient than other closely related ones, and b) when properly cured, the finish has more alkali resistance than would be expected of an anhydride. In some cases the durability rivals that obtainable with a supplementary crosslinker.

Reaction with the substrate—which may in a few instances be possible—does not explain the durability, since a film of the copolymer alone, properly cured, will be water and solvent resistant.

AMIDO AND AMINO———There are many patents covering nitrogenous reactive monomers. For example:

U S Pat 2,886,474 concerns pigment dyeing and printing with copolymers of a large number of amido- and amino-containing monomers, including:

acrylamide	$CH_2=CH.CONH_2$
methacrylamide	$CH_2=C(CH_3).CONH_2$
2-aminoethyl vinyl ether	$CH_2=CH.O.CH_2CH_2NH_2$

U S Pat 2,883,304 covers pigment binding with polymers containing urea derivatives such as ureidovinyl ether ($CH_2=CH.O.CH_2CH_2NHCONH_2$).

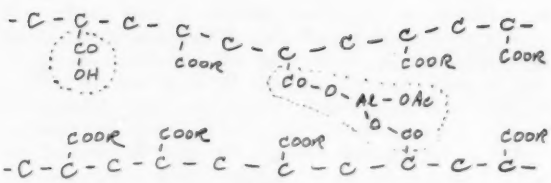


Figure 1

U S Pat 2,719,072 discloses copolymers of ureidoethyl acrylate ($CH_2=CH.COOCH_2CH_2NHCONH_2$) and the corresponding methacrylate for shrinkproofing of wool.

Amido- or amino-containing copolymers will react readily with supplementary crosslinkers such as urea formaldehyde, cyclic urea formaldehyde, melamine formaldehyde, or formaldehyde itself. Acid catalysis is ordinarily employed.

The reaction is a commonplace one:

$$\text{(Polymer)CONH}_2 + \text{HOCH}_2\text{(R)CH}_2\text{OH} + \text{H}_2\text{NOC(Polymer)} \longrightarrow \text{(Polymer)CONHCH}_2\text{(R)CH}_2\text{NHOC(Polymer)}$$

Choice of catalyst will depend on the formulation. If a small amount of acrylic is to be added to a large amount of, say, cyclic urea resin for use in a crease-proofing finish, then zinc nitrate might be used as catalyst. However, where the acrylic is the major component, catalysts such as oxalic acid or ammonium chloride or nitrate will usually be preferable.

Many amido- or amino-containing copolymers will undergo what appears to be a crosslinking action on application of heat alone, in the absence of an auxiliary crosslinker or catalyst. The chemistry of this reaction has not been given more than a cursory study. The phenomenon is best known in terms of its utility in end use; that is, washfastness is considerably enhanced over what it would be if the functional group were not present. It is possible that imido- or imino-crosslinks are formed:

$$\text{(Polymer)CONH}_2 + \text{H}_2\text{NOC(Polymer)} \longrightarrow \text{(Polymer)CONHOC(Polymer)}$$

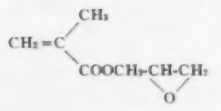
On the other hand, there are cases where much of the effect could be due to strong hydrogen bonding between the polymer chains, which are already mechanically intertwined.

Reaction with the substrate is also a possibility, as in the case of ureidoethyl-containing copolymers, which could theoretically react with wool or cellulose by way of an isocyanate intermediate:

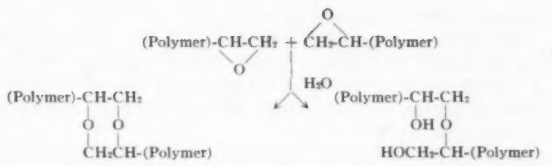
$$\text{(Polymer)} \ldots \text{NHCONH}_2 \longrightarrow \text{(Polymer)} \ldots \text{NCO}$$

However, these possibilities are sheer conjecture. The situation has not been further studied because in most instances better results are obtained through the use of an auxiliary crosslinker.

EPOXY———Another type of functional monomer contains the epoxy group as the basis of its reactivity. For example, German Patent 1,000,782 relates to pigment binding with copolymers of glycidyl methacrylate,



The crosslinking reaction, which requires acid catalyst and cure, may proceed in one of several ways:



The structure on the left will be obtained where steric relationships and reaction conditions are ideal. The structure on the right will result, for example, where one of the epoxy groups is hydrolyzed during manufacture or storage of the polymer or during application to the fabric, and is then reacted with another epoxy group.

Epoxy groups will also react with any carboxyls or amines that happen, either by accident or design, to be present in the system. Thus, inter-polymer crosslinks could occur on the addition of an amino- or carboxylic-polymer, while simpler crosslinks between the epoxy polymer molecules could result through reaction with dicarboxylic acids or diamines.

HYDROXY——Crosslinking can also be obtained through hydroxyl groups. This is a well-known principle in textile finishing; a time-honored example is the fixation of starch, polyvinyl alcohol, and other hydroxy-containing polymers by reaction with thermosetting resins.

A terminal hydroxyl at the end of a long straight chain is particularly effective. Thus U S Pat 2,780,567 covers wool stabilization with copolymers containing such monomers as 5-hydroxypentyl vinyl ether ($CH_2 = CH.O.CH_2CH_2CH_2CH_2CH_2OH$). U S Pat 2,923,-653 relates to bonding of nonwoven fabrics with copolymers of hydroxyalkylacrylates and methacrylates.

As with other hydroxy-polymers, best results are obtained by coreaction with a supplementary crosslinker such as formaldehyde or a formaldehyde resin. But experiments in pigment binding have shown that very good washfastness can be obtained through the use of a long-chain hydroxy-polymer alone, set by heat. Shorter hydroxy side chains such as those obtained by hydrolyzing copolymers containing vinyl acetate, do not give such a result.

The mechanism of this apparent reactivity of long-chain hydroxyls in the absence of supplementary crosslinker has not been determined.

In concluding this brief and incomplete discussion of crosslinking of acrylic polymers, we must again emphasize that there are certain points that are conjectural. In such cases it is difficult to avoid circular reasoning: that is, since covalent crosslinking is known to improve washfastness, there is a temptation to assume that any significant improvement in washfastness must be evidence of covalent crosslinking.

In a way, the situation is similar to that encountered in creaseproofing with thermosetting resins and reactants: because covalent crosslinkers improve crease recovery, improvement in crease recovery is therefore assumed to be evidence of covalent crosslinking. Such assumptions are not always valid.

Nevertheless, covalent crosslinking is an accomplished fact, and in practice it is the most certain way of improving the fastness properties.

PRACTICAL APPLICATIONS

Some of the applications in which reactive acrylics are being used will be discussed in the sections below.

Many of the cited formulations represent actual mill practice, and it is therefore expedient to give trade names rather than chemical compositions of the products. However, in each case an attempt will be made to emphasize the principles of the operation rather than the formulation.

TABLE III
Range of hand modification

Treatment (5% applied solids)	*Relative stiffness (Gurley, mg/inch)*	*Hand or feel*
Water Control	6	Soft
Rhoplex HA-4	5	Very soft, full
Rhoplex B-15	7	Soft, full
Rhoplex HA-8	7	Soft, full
Rhoplex HA-12	15	Leathery
Rhoplex HA-16	32	Stiff

*Each treatment contained 0.3% ammonium chloride catalyst, except Rhoplex B-15, which requires no catalyst. The Rhoplex HA-4 treatment also contained 1% Rhonite R-2 as auxiliary crosslinker.

DURABLE BODYING AND STIFFENING——Stiffening agents operate by bonding the fibers together in the yarns, and the yarns together at the crossover points. Any film-forming material with adequate adhesion is a potential stiffening agent, and the harder the film the stiffer will be the treated fabric (*8*).

Film hardness depends primarily on the composition of the backbone polymer. Crosslinking tends to increase the hardness, but usually the proportion of reactive groups is so small that hardness is not greatly affected. As a result, crosslinked acrylics will provide the same wide range of fabric stiffness, from very soft to quite stiff, for which uncrosslinked acrylics have long been noted. This is illustrated in Table III, which compares five commercially available reactive acrylics.

It might be expected that crosslinking would improve the durability of stiffness, and this may sometimes be true. However, in all fairness to uncrosslinked polymers it must be recognized that there are two opposing factors that complicate the situation: 1) the breaking of bonds by mechanical action during washing, and 2) the resealing of the bonds when fabrics are subsequently ironed or pressed. Thus, all stiff finishes tend to break down, becoming more mellow as the result of severe tumble washing. This is due not to loss of polymer, but to failure of fiber-to-fiber bonds, so that in some cases the stiffness can be restored by damp pressing, which reseals the bonds. Now crosslinking tends to reduce the breakdown on washing, but also tends to minimize resealing, so that the effects often cancel each other.

As a result, the selection of a reactive acrylic rather than an unreactive one for bodying or stiffening will usually be based on other features. As we shall see, the newer reactive acrylics (HA-8, -12, -16) impart a fair degree of dimensional stability to certain fabric constructions.

Similarly, the choice of a reactive acrylic over a non-acrylic polymer will often be based on superior resistance to aging. Acrylics as a class resist yellowing or embrittlement on exposure to heat and light. We shall return to these points later.

DURABLE SOFTNESS——Even the softest acrylics impart a full bulky hand to fabric, and so cannot be classed with the waxy or greasy softeners that lubricate fibers and promote interfiber slippage. But it should be noted that soft acrylics may be used as plasticizers in formulations that include starch, polyvinyl alcohol, polymerized urea-formaldehyde resin and the like. Crisp finishes are made more mellow, and strength is sometimes improved.

SHRINKPROOFING —— Reduction in felting shrinkage of wool through the application of surface

resins is well known (*6, 15*). Wool felts because of the extension and contraction of the fibers during laundering, together with the ratchet effect of the scales (which permit migration only one way). Surface resins overcome felting partly by spot-welding the fibers, thus reducing migration, and partly by masking the scales so that they are less likely to interlock.

While many types of reactive resins will prevent felting, there are important differences between them. For example, thermosetting surface resins usually impart undesirable stiffness; soft thermoplasts provide a much more suitable hand. The use of reactive acrylics in this application is illustrated in Table IV.

TABLE IV
Reduction in felting shrinkage with reactive acrylic polymers

Treatment (% product)	*Hand*	*Felting shrinkage (five hours at 140°F)**
Water Control	Normal "wooly"	54
6% Exp Dispersion WF-192 1% sulfuric acid 0.01% Triton X-100	More full	2
6% Rhoplex HA-4 0.75% Rhonite R-2 0.5 % ammonium chloride 0.05% Triton X-100	Quite full	4

*Reduction in area after five hours tumble washing at 140°F.

While flannels can usually be stabilized with 3% applied solids, other constructions may require as much as 10% or more. The resulting build-up of hand can be minimized by starting with a lighter fabric. A fabric that is 90% wool and 10% thermoplast will not feel much different than the original heavier fabric, and will be very resistant to felting.

Shrinkproofing of cotton and rayon fabrics with reactive acrylics is also possible, though subject to many variables. The effect was first observed when a pile fabric with a knit cotton backing was backcoated to hold the pile in place. On washing, it was found that a marked degree of shrinkage control had been obtained.

Subsequent trials on a variety of cotton and rayon goods produced variable results, ranging from fair to very good. Because such polymeric finishing agents are restricted to the surface of the fibers and therefore must function entirely through the formulation of flexible fiber-to-fiber bonds, fabric construction is very important. In many cases, however, the shrinkage can be cut approximately in half, *without the reduction in strength that would accompany internal modification of the fibers.*

The marked advantage in strength resulting from the use of soft surface resins instead of internal fiber modifiers is shown in Table V. The fabric in question was a cotton drapery webbing, four inches wide. The problem was to reduce lengthwise shrinkage. With cotton, internal modifiers lowered the strength, whereas soft surface resins increased the strength. A combination of internal and surface resins gave optimum shrinkage control with no change in strength.

TABLE V
Shrinkproofing with internal versus surface resins

*Resin product**		*Shrinkage***		*Tensile strength (grab, lbs)*
Internal (Rhonite R-2)	*Surface (Rhoplex HA-8)*	*% Decrease in length, One wash*	*Two washes*	
0	0	11.6	12.2	127
4	0	5.7	7.6	109
8	0	5.0	5.7	98
0	5	6.8	9.1	127
0	10	6.8	7.8	133
0	20	5.5	6.0	142
4	10	3.9	5.2	127

*Catalyzed with 0.25% NH_4Cl, cured two minutes at 320°F.
**Household tumble-wash, 120°F.

Similar results can be obtained on many types of cotton or rayon knit goods, which for best results require a combination of internal and surface resin. Lengthwise shrinkage and crosswise stretch are both markedly reduced.

With Acrilan, nylon and other all-synthetic fibers, penetration into the fiber is so limited that shrinkage control must be accomplished by surface modification alone. In such instances, use of a reactive acrylic will often cut the shrinkage (or stretch) in half, as with cellulosic fabrics.

One disadvantage of surface over internal modification is the increase in hand which results. With drapery webbing, increased stiffness is desirable, but with other fabrics it may be quite undesirable. It is fortunate that reactive acrylics are available in a wide range of stiffness.

DURABLE EMBOSSING——Reactive acrylics in combination with cellulose reactants have also been found useful on fabrics that are to be embossed. The acrylic and cellulose reactant are of course cured or set after the pattern has been pressed into the fabric. The result is a full-bodied to slightly crisp fabric depending on the acrylic chosen) having in some cases greater strength and greater durability of pattern than if the same hand had been obtained with other additives.

CREASE RECOVERY AND "WASH-WEAR"——The ability of cellulosic fabrics to remain smooth while wearing and to dry smooth after washing is most effectively brought about by treatment with resins or reactants inside the fibers. However, a variety of surface modifiers may be added to the treating bath, not only to enhance the crease recovery or "wash-wear" effect, but to add body, alter the draping qualities, or increase strength (*7*).

The utility of soft thermoplasts in this application has long been recognized (*1, 2, 13*). Typical of the combinations which were early found to be useful on cotton is the following:

10% Rhonite R-1 (DMEU)
3% Rhoplex B-15 (soft acrylic)
1% Rhotex A-9 (fiber lubricant)
1% silicone emulsion (lubricant)
0.5% zinc nitrate

All concentrations are on a % product basis.

In a formulation such as this, the cellulose reactant (DMEU) goes inside the fibers and produces most of the crease-recovery effect. The acrylic improves crease recovery and tear strength, and also adds body. The other ingredients are durable softeners which lubricate the fibers, both to enhance tear strength and to improve sewability. The silicone also serves as a running aid.

More recently, triazones such as Rhonite resins D-12 or N-17 have largely replaced the DMEU, for better chlorine resistance; polyethylene emulsion has replaced the silicone, primarily for lower cost; and Rhoplex HA-8 (soft) and HA-12 (leathery) have replaced the Rhoplex B-15, because of their greater smooth-drying potential.

For use on cotton, the acrylic need not necessarily be a reactive one—in fact, any soft polymer, acrylic or non-acrylic, will do—but reactiyity adds to the durability of the effect. For best results, the acrylic should be soft to moderately hard; very hard polymers will detract from the dry crease recovery.

The exact formulation will depend on such factors as fabric construction, the hand desired, and above all, the whim of the finisher. There is no "one-best"

wash-wear formulation for cotton. However, reactive acrylics have proven their merit in such formulations.

Rayon poses a special problem: whereas with cotton a reasonable degree of wet and dry recovery may be obtained without surface resin, rayon requires surface resin for good *wet* recovery (*7, 14*). Accordingly, formulations such as the following have been used commercially on lightweight rayon fabrics:

20-25% Rhonite R-1 (DMEU)
1.5% Rhonite 313 (polymerized UF resin)
10-15% Rhoplex HA-4 (very soft acrylic)
1% Rhotex A-9 (lubricant)
1% zinc nitrate

Reactive acrylics are also being used in combination with formaldehyde and other nonnitrogenous crosslinkers, on both cotton and rayon.

LOOM FINISHING———In a loom finish the polymer is applied to the warp yarns, to serve as a size, and allowed to remain in the fabric after weaving, so that it also serves as a finish.

While comparatively little study has been undertaken, there are indications that the stiffer reactive acrylics (such as Rhoplex HA-16) have utility in this application. In addition to providing stiffness, the polymer will also reduce the shrinkage in the warp direction.

UPHOLSTERY BACKING———Backcoating is the application of binder or binder-filler mixture to the underside of a fabric for one or more of the following purposes: locking the pile; preventing raveling, slippage, distortion, or shrinkage; or adding body or weight. Common methods of backing include knife-coating, kiss-roll application, and—more rarely—spraying (*9*).

The choice of binder is based on such considerations as hand, cost, aging properties, and durability; and here again it is the durability factor that makes reactive acrylics superior to the unreactive types. With certain upholstery fabrics, for example, the construction is such that is is necessary to back the fabric immediately after weaving, before any wet processing is undertaken. Where such fabrics are to be dyed, extreme durability is required, as the dye cycle may run eight hours at the boil. Crosslinked binders are therefore essential.

Yarn-dyed upholstery fabrics and automotive fabrics do not require such extreme durability. Nevertheless, crosslinking will still be desirable because of the greater resistance it provides to local scrubbing with water or solvent. Crosslinked *acrylic* binders are particularly useful, because they also have good aging properties and do not discolor or stiffen on exposure to heat and light.

Backcoating formulations may be simple or complicated, depending on the end-use requirements. Among the simpler formulations is this clear (unfilled) backing for automotive fabrics:

40% Rhoplex HA-8
1% Acrysol ASE-60 (thickener)
qs ammonium hydroxide to pH 8.5

Acrysol ASE-60 is an acrylic dispersion that solubilizes and thickens on addition of alkali, as was explained earlier. For automotive use, where extreme durability is not required, catalyst can be omitted from the mix.

Somewhat more complicated is this filled backing for upholstery fabric that is to be dyed after weaving:

50% Rhoplex B-15 (soft acrylic)
10% McNamee clay (filler)
0.1% Tamol 731 (dispersing agent for filler)
4% Aerotex M-3 (supplementary crosslinker)
1% Catalyst AC (catalyst for crosslinker)
0.5% Methocel 4000 (thickener)
qs ammonium hydroxide to pH 8.5
qs antifoam

The filler content is 40% based on resin solids: the mix will have a viscosity of about 6000 cps, and the backed fabric will withstand a prolonged dyeing cycle if cured for several minutes at 280°F or above.

RUG BACKING———The backing of rugs falls into two general classes. With tufted rugs, the problems may be similar to those encountered with furniture upholstery fabrics. Such rugs are sometimes dyed after backing, and durability requirements are therefore severe. Moreover, small tufted throw rugs are often tumble-washed in end use.

Conventional carpeting poses a different problem. Rugs may contain 20 ounces or more of backing per square yard; washfastness and aging requirements are usually not critical; therefore cost is the primary consideration; accordingly, the concentration of filler is quite high.

Crosslinked acrylics have not attained any degree of acceptance in rug backing, except in a roundabout way: certain acrylics, which incidentally happen to be crosslinkable, also have good adhesion to fibers, and are capable of a fairly high degree of loading. Rhoplex B-15 is an example of such an acrylic; it will provide excellent bonding when loaded to the extent of several hundred percent (*9*).

BONDING OF NONWOVENS———In a nonwoven fabric the fibers are held together by means other than knitting or weaving. There are at least nine techniques for bonding a nonwoven (*9*), and reactive acrylics are useful in four of them:

a) *Printing:* local application of thickened binder in the form of a printed stripe or other pattern.
b) *Padding:* more or less complete saturation of the web with a solution or dispersion of the binder; this is one of the most widely used methods of bonding thin webs.
c) *Spraying:* this gives a lower degree of bonding than does a pad application, but the resulting web is loftier.
d) *Foaming:* impregnating with a frothy mixture of binder and foaming agent; widely used for interlinings and for two-ply laminated nonwovens for outerwear (*17*).

The advantage of a reactive acrylic (Rhoplex B-15) over a nonreactive acrylic has already been illustrated (Table II). Even greater durability at the same cure, or equal durability at lower cure, may be obtained through the use of the newer reactive acrylics (HA-8, -12, -16). As was pointed out earlier, such products are available in a range of hardness. The softer ones are used for padding applications, where 25% to 50% solids on the weight of the fiber are ordinarily applied. A typical formulation, using catalysis to permit low-temperature cure, is as follows:

25% Rhoplex HA-8 (soft) or HA-12 (leathery)
0.1% oxalic acid

Pad at 150% pickup, dry and cure five minutes at 250°F. The fabric will be soft to moderately firm, and quite resistant to washing and drycleaning.

The harder acrylics are more often sprayed onto the surface of thick webs to be used as furniture padding or fluffy linings for hunting jackets and winter clothing. Here the solids add-on rarely exceeds 10%, the purpose of the binder being to lock the surface fibers in place, thus giving shape and handleability to the

web during fabrication into the finished article, and also preventing the fibers from working through the outer fabric in end use. A harder acrylic such as HA-16 is particularly applicable because it forms a dry, strong surface bond that permits the padding to be rolled up for storage and later unrolled for fabrication.

With regard to the printing and foam methods of binding, typical formulations for thickening and foaming acrylics will be described later in the section on Laminating.

Regardless of the method of application, if a reactive acrylic is properly cured it becomes so solvent insoluble that it cannot be removed to determine the binder content of a bonded nonwoven. In a few instances the *fibers* can be dissolved away from the *binder*, but in the case of Dacron the powerful fiber solvents convert the copolymer into a dispersed gel that is difficult to filter out. In a clever analytical scheme devised by Kantner and Hoey (5), the bonded web is immersed in a hot dye solution which differentially colors the binder; the dyestuff is then extracted from the binder with alcohol, measured colorimetrically, and compared with similar extracts from webs of known binder content.

PIGMENT DYEING AND PRINTING———The coloration of textiles by means of pigments fastened to the fibers with polymeric adhesives is one of the oldest of textile processes. The patent literature is very extensive, and will not be reviewed here. Suffice to say that over the years, pigment binding formulations have tended to become more and more complicated. Some of the present-day commercial systems contain most or all of the following ingredients:

Pigment—to provide color
Solvent-soluble butylated melamine—primary binder, for wash- and drycleanfastness.
Alkyd or polyester—emulsifier, better color value, additional binding
Soft thermoplastic polymer—anticrock
Dispersant for the pigment
Additional emulsifier
Varsol—to thicken for printing
Methyl cellulose—supplementary thickener (or antimigration agent for dyeing)
Alkali—for pH adjustment

In all of this complexity, acrylics may be thought of in at least two ways: a) as the anticrock component in a system such as the above; or b) as sole binder, providing wash- and drycleanfastness as well as anticrock, in a system containing little or no butylated melamine.

In regard to anticrock properties, butadiene latices are widely used because of their efficiency. However, they tend to yellow and stiffen with light and heat. Certain reactive acrylic copolymers closely approach butadiene copolymers in efficiency, and also have excellent aging properties. Hence, acrylics are coming into wider use in this application.

The acrylic need not necessarily be a reactive one—anticrock effect is based on physical properties rather than chemical reactivity—but it should be obvious that a reactive acrylic will be more durable than an unreactive one.

A reactive acrylic anticrock (such as Rhoplex B-27) can be substituted directly for the rubber latex in almost any pigment dyeing or printing system. However, in keeping with the trend toward simpler systems, the following pad-dyeing formulation will be cited:

2% Rhonite 401 (melamine resin)
1% Rhoplex B-27 (acrylic)
2.5% Monastral Blue BFR (pigment)
0.1% Keltex S (antimigration agent)
qs ammonium hydroxide to pH 8.

All concentrations are on a % product basis. The ratio of binder to anticrock to pigment (solids) is 2:1:1. Rhonite 401 is a new type of butylated melamine that is self-dispersible in water. Rhoplex B-27 is a reactive acrylic having good durability, aging and anticrock properties. The fabric is merely padded, dried, and cured three minutes at 300°F.

For printing, a solvent-soluble melamine resin will customarily be employed. As noted above, such systems are usually very complicated. This is one of the reasons for the recent trend toward systems based on a reactive acrylic serving as both binder and anticrock. An example is the following:

17% reactive acrylic (Rhoplex B-27, HA-8, or JR-172B)
1% Methocel 4000 (thickener)
25% water
41% Stoddard solvent (thickener)
15% Monastral Fast Green GFNP (pigment)
1% ammonium nitrate (catalyst)

In other cases, a compromise formulation is used: only part of the butylated melamine is omitted from a "traditional" system and replaced by reactive acrylic, the latter serving as supplementary binder as well as anticrock. It is probable that some formulators are even using acrylics as supplementary binders in conjunction with both butylated melamine and butadiene latex, the latter serving as anti-crock.

As in wash-wear finishing, there is no "one-best" formulation for pigment binding. But reactive acrylics appear to have unusual merit either alone or in combination with other polymeric materials (*9*).

LAMINATION———A textile operation that has grown to tremendous volume during the past year or two is the bonding of polyurethane foam to fabric (*11*). The resulting laminate has warmth and resilience, and is ideal for insulated clothing.

Originally, such lamination was achieved by melting the surface of the foam and fusing it to the fabric. But to an increasing extent, adhesives are being used to accomplish the same result.

The same adhesives may be used to bond fabric-to-fabric or vinyl film-to-fabric.

An adhesive formulation that has been in use since 1958 comprises a reactive acrylic and a supplementary crosslinker:

89% Rhoplex B-15 (acrylic)
10% Rhonite 401 (crosslinker)
1% ammonium hydroxide (to pH 8.5)

The Rhoplex B-15 thickens on addition of the ammonia; the resulting paste has a viscosity in excess of 25,000 cps and is ideal for knife coating, though it will have to be reduced somewhat by addition of water for kiss-roll application. The paste is knifed or otherwise spread onto either the fabric or the foam, whichever is the less open or absorbent. The fabric and foam are then pressed together and baked for a few minutes at 300°F. The resulting laminate is fast to washing and drycleaning.

In order to obtain a softer hand and greater porosity, the adhesive may be printed or otherwise applied in the form of stripes, dots, or other discontinuous pattern. As an alternate method of accomplishing the same result, the adhesive may be converted into a foam and applied with a knife.

The foamed mix is prepared as follows: the ammonium hydroxide is omitted, and the mix is stirred at high

speed until it foams up to at least twice its original volume. Then the ammonia is added, and the mix is further stirred to produce a stable foamed adhesive. This is knifed onto either the fabric or the polyurethane foam and the lamination is carried out as before.

Other reactive acrylics may be used, but each will require its own particular formulation. Thus, if Rhoplex HA-8 is chosen, the supplemental crosslinker may be left out; but catalyst and thickener will have to be added:

86% Rhoplex HA-8 (acrylic)
3% Acrysol ASE-60 (thickener)
0.1% oxalic acid (catalyst)
0.9% ammonium hydroxide (to pH 8.5)
10% water

If the mix is to be foamed, the ASE-60 is omitted and an additional 20 parts of water are added; the mix is foamed by stirring at high speed; then the ASE-60, diluted with three volumes of water, is stirred in at moderate speed.

Laminations can also be carried out with solvent-based adhesives, which have the advantage of quicker drying. Acryloid K-7003, a coating resin discussed in the next section, is the major ingredient in one such formulation.

COATED FABRICS———A specialized operation in which most textile mills never become involved is the coating of fabrics for such uses as waterproofed nylon rainwear, tarpaulins and the like. Yet it is just as easy to set up for such an operation as it is to bond nonwovens or to laminate foam to fabric.

Most coatings traditionally have been applied from solvent solution. Polymers used have included rubber, polyvinyl chloride, polyvinylbutyral. During the past few years reactive acrylics have entered the picture, particularly for the production of nylon and Dacron rainwear; and brief descriptions will be given of two such systems.

The first is a solvent system, comprising a very soft basecoat (Acryloid K-7003) and a harder topcoat (Acryloid K-7004). These are supplied as clear viscous liquids of coating viscosity, requiring only the addition of a suitable catalyst before knifing onto the fabric, drying and curing. The soft basecoat provides adhesion between the fabric and the harder and drier topcoat. Together they produce a soft, flexible fabric having unusually good resistance to both washing and drycleaning. It is interesting to note that if the reactive groups were omitted from the copolymers, the coating would have somewhat less washfastness and no drycleanfastness at all.

The second coating system involves aqueous dispersions, which are inherently cheaper than solvent types. The problem here has been to obtain a satisfactory degree of flexibility, because if copolymers of equal hardness are applied from aqueous and solvent systems, the aqueous application will produce a relatively crisp hand. Attempts to solve this problem through the use of an even softer basecoat have resulted in higher cost and relatively poor drycleanfastness.

The crisp hand may be due in small part to the fact that such aqueous systems usually require addition of a thickening agent, which in itself tends to add stiffness. Unfortunately, copolymers which are self-thickening (eg, by simple addition of ammonia) do not give an appreciably softer result.

It has been found recently that the crispness can be avoided by preventing excessive penetration of the basecoat. If this is accomplished by pretreating the fabric with a water-repellent, durability of the coating will suffer. A much more effective method has been devised by Seifer (*12*) who pads the fabric through Stoddard solvent and applies the basecoat to the wet fabric. Through this procedure, a coating comprising thickened Rhoplex HA-8 as the basecoat and thickened Rhoplex HA-12 as the topcoat will be as supple and as durable as though the coating had been applied from solvent solution.

Where extreme suppleness is not required, the pretreatment can be eliminated. The resulting fabric will have a slight crispness that may not be objectionable in many uses.

Acrylic coatings will ordinarily be clear and glossy, but dulling agents or colored pigments may be added if desired. Alternately, aluminum or bronze powder may be incorporated for heat-reflective or decorative effects.

CONCLUSION

In this discussion of reactive acrylics, our outlook has been as broad as possible, with no attempt to delve deeply into any one aspect of the subject.

Our purpose will have been served if we have:

a) attracted your attention to reactive acrylics as a new and versatile class of textile finishing agents,
b) helped you to understand their chemistry, and
c) impressed you with the way in which they can fulfill the end-use requirements in many textile applications.

In the future we hope to publish further details concerning certain of these applications. In the meantime we trust that you will have become sufficiently interested to investigate their potentialities in your own operations.

TRADEMARKS

Acryloid—Rohm & Haas Co
Acrysol—Rohm & Haas Co
Aerotex—American Cyanamid Co
Catalyst AC—Monsanto Chemical Co
Monastral—E I du Pont de Nemours & Co, Inc
Methocel—Dow Chemical Co
Rhonite—Rohm & Haas Co
Rhoplex—Rohm & Haas Co
Rhotex—Rohm & Haas Co
Tamol—Rohm & Haas Co
Triton—Rohm & Haas Co

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III. "Wash-and-Wear" Research in 1961— A Step Closer to Garment Evaluation

GRAHAM M RICHARDSON
Chairman, Committee RA61
Wash and Wear

I will tell you about some of the work of the Wash & Wear Committee that has just been completed and also about some that is still in the developmental stages. Our committee has already developed tentative procedures for evaluating the appearance of fabrics after home laundering. These have gained wide acceptance by industry and are being used by many laboratories. We are presently evaluating a new procedure for rating the appearance of creases and seams. This method brings us closer to being able to evaluate "wash-and-wear" garments.

Before talking about the technical program of our committee, I would like to comment on two other areas of our work; namely, the personnel and the objectives. First let's consider the personnel.

The Committee has had an active membership of about 30 with meetings well attended. In addition there have always been a number of guests present. The reason for mentioning these two facts is to use the large size of the Committee and the good attendance to give you an idea of the interest that has been displayed in "wash-and-wear" and in developing procedures for its evaluation. As a result, our subcommittees have had excellent cooperation and participation in carrying out the various tasks chosen for study. One group worked an entire weekend in order to meet a publication deadline. Such an industrious and cooperative group is hard to find, but on the other hand, is a great source of pleasure to those of us associated with the Committee. The membership contains a good cross-section of the entire textile industry starting with fiber and fiber producer, going on to greige mills, dyers and finishers, retailers, testing laboratories, shelter magazines, fabric marketers, laundering-equipment manufacturers, research laboratories, chemical and dye manufacturers, and college home economics departments. Indeed these categories are represented on the Committee by some of the leading institutions in America. Let's now switch our attention to the objectives of the Committee.

The Wash and Wear Committee started out initially to be primarily a committee devoted to developing laundering procedures and procedures for measuring the smooth appearance of fabrics after they have been subjected to laundering. It soon became a joke in our committee that only a limited segment of the population of the world would be satisfied to wear *just fabrics*. There had to be some sewing and creasing before "wash-and-wear" became a reality. Accordingly, it was decided by the Committee that the textile industry could only be served by aiming our tests at garment evaluation rather than fabric evaluation.

In order to accomplish this objective it became necessary to develop laundering and drying procedures representative of those used in the home. In addition, methods for measuring the smooth appearance of fabrics were needed. It became apparent that two procedures must be provided for evaluating smooth appearance. Namely, one involving a low-angle lighting procedure for use where the evenness of the fabric surface is the major concern, disregarding prints and surface texture and, in addition, another procedure concerned primarily with the appearance of the fabric, integrating the camaflouging effect of prints and surface textures. Beyond this, methods for evaluating the appearance of creases

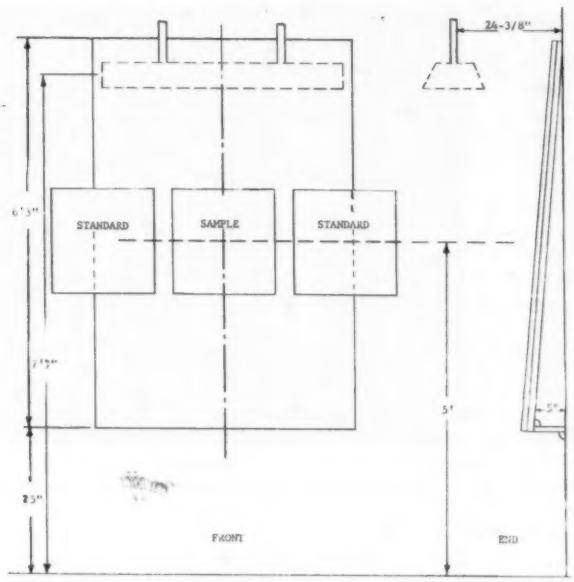

Figure 1
Lighting equipment for viewing test specimens with overhead lighting

MATERIALS LIST
2—4′ White fluorescent tubes, 40-watt (without baffle or glass)
1—White enamel reflector (without baffle or glass)
1—General-type swatch mount, spring-loaded, fabricate using light sheet metal (22 ga)
1—¼" Plywood mounting board, OD 6'9" × 4'3". Paint gray to match No. 2 rating on International Gray Scale for Staining.

and seams after laundering were needed. With these tools it is now almost possible to think in terms of devising a procedure for evaluating "wash-and-wear" garments. The comments which follow will deal with the development of these procedures.

First let's talk about the procedure for evaluating the "Appearance of Wash and Wear Fabrics After Home Laundering." This procedure was published in the September 4, 1961, issue of the *American Dyestuff Reporter* and was developed under the subcommittee of which Claude Clutz of Celanese is chairman.

The elements of this test are as follows:

1) Test Specimen 15" × 15"
2) Laundering Procedures

Washing Procedure	*Drying Procedures*
I Hand Wash 105°F	A Drip
II Machine 105°F	B Line
III Machine 140°F	C Tumble

3) *Evaluation Procedures*

1. Low-angle Lighting	Use either three-dimensional replicas or photography*
2. Overhead Lighting	Use photographs*

*Photographs for low-angle lighting cannot be used with overhead lighting and vice versa.

One desiring to use this procedure has a wide choice of laundering methods. However, this is necessary, since fabrics and garments require, as a minimum, this variety of procedures to anticipate performance in the different consumer uses for which they are intended.

A finishing plant making a carefully controlled fabric, let us say a cotton print cloth with a busy print, would probably use a temperature of 140°F for laundering, they would tumble dry and probably use low-angle lighting in order to see beyond the effect of the print to the real performance of the fabric. On the other hand, a similar plant making a plain-dyed polyester-cotton blend would probably use machine washing with water at 105°F and tumble dry. Again, they would use the low-angle-lighting procedure to evaluate the smooth appearance of the fabri .

Others, such as cutters, testing laboratories or retailers, would prefer to use the same laundering procedures but would choose overhead lighting for evaluation since they would be concerned only with the appearance of the fabric, not standardization of a finishing procedure. Both methods are most helpful to the textile industry, each serving its specific need.

Through the development of the overhead-lighting method, the first step toward garment evaluation has been taken. It permits the evaluation of articles in a hanging position and in a light aimed at evaluating only appearance. Starting here, it now is possible to consider other components of garments, such as creases and seams. George Wernz of Eastman is chairman of the subcommittee working in this area and my next comments will cover the work of his subcommittee.

It was fortunate the same laundering and drying procedures developed for smooth-appearance evaluation could also be used for evaluating seams and creases. With this good start it then remained to choose specimen-size, seam types and get a range of appearance within the selected types. This all sounds very easy but selecting the spread of single and double seams to portray the range of 1 to 5 can involve a lot of preparations not to mention the many discussion sessions required to reach a degree of practical agreement. Once the tentative range is selected, it becomes a job of making professional photographs of the standards under the same lighting conditions to be used for evaluating the components. We were fortunate in this respect to have Eastman represented on our committee since that company was most helpful in making photographs. Let's now switch our thoughts to the lighting arrangements used for evaluating seams.

For evaluating seams it was possible to use the same diffuse-overhead-lighting procedure as was used for evaluating the smooth appearance of fabrics (Figure 1). The single or double seam was hung in a vertical position on the test panel (Figures 2 and 3). However, it was not so easy in the case of creases.

Since the most common crease is the one found in trousers and this one

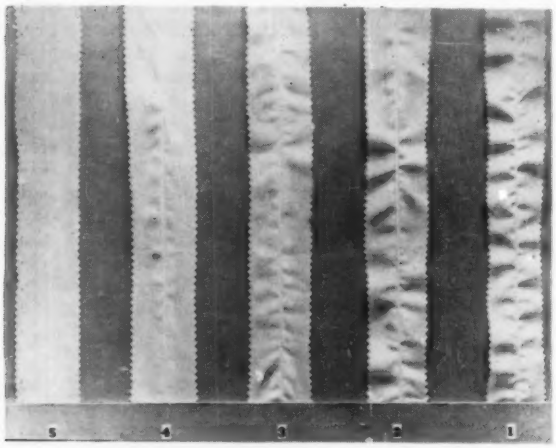

Figure 2
Proposed comparative ratings for single seams

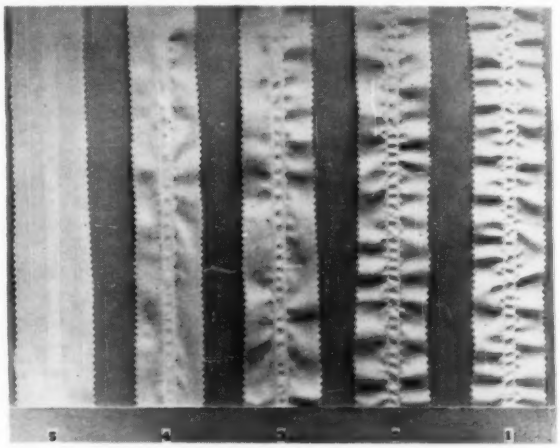

Figure 3
Proposed comparative ratings for double needle seams

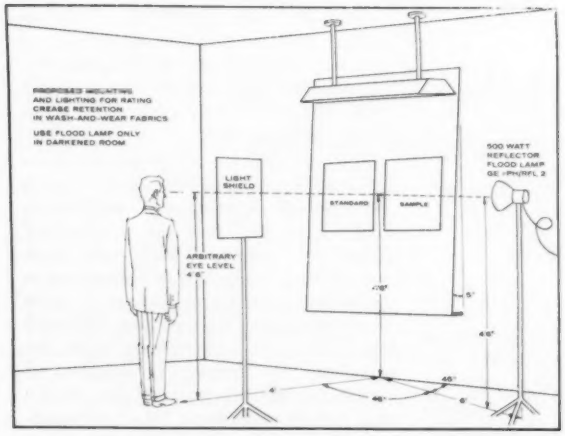

Figure 4
Lighting and viewing arrangement for rating crease retention

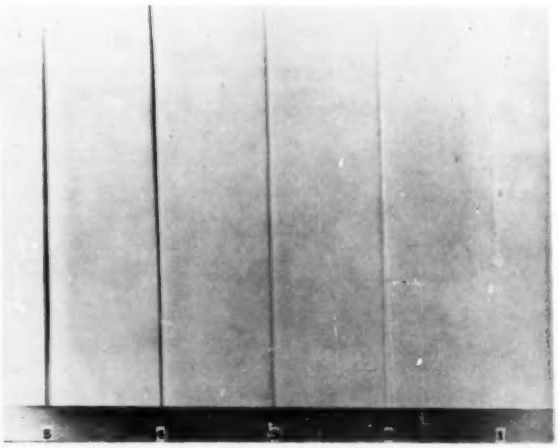

Figure 5
Proposed photographic comparative ratings for crease evaluation

is in a vertical position, it was decided to do the testing of the creased panel in this position. The overhead-lighting procedure proved unsatisfactory for obvious reasons, but it was fortunate the viewing board could be used for hanging the specimen with the crease in a vertical position. This lighting problem caused the subcommittee to develop a new lighting technique involving the use of a spot light placed so the light impinged on the test panel at an angle of 45° (Figures 4 and 5). Using this procedure, an interlaboratory test was conducted.

The results of the test have shown fair agreement. On the other hand, it was concluded that "the apparent need for the methods (both creases and seams) for industry-wide use in the evaluation of these properties; the demonstrated ability of these procedures to fulfill, at least partially, the criterial for such procedures; and the opportunity present for their further improvement; all indicate their adoption by AATCC as tentative procedures to be a favorable course of action." Accordingly the procedures are being considered by the Wash and Wear Committee, and if it reaches agreement to recommend them, they will be submitted to TCR.

It is sincerely hoped that this procedure will receive favorable action by TCR since it represents many hours of hard work by the Committee. Upon adoption as a tentative method the next job will be to immediately refine and improve the procedures.

In reporting on the Wash and Wear Committee activities, I am always reminded of the fact that what I report to you in a few minutes has taken several dedicated Committee members hundreds of hours of hard work over the past three years. Accordingly, I think it appropriate at this time to publicly express my appreciation to the members for their faithful cooperation and hard work and to their companies for permitting such devoted people to use their time and facilities in this important endeavor.

IV. Investigation of Colorfastness of Textiles to Atmospheric Contaminants

VICTOR S SALVIN
Chairman, Committee RA33
Colorfastness of Textiles to Atmospheric Contaminants

IN this industrial age, the air contains a number of chemicals in addition to its normal complement of gases. These chemicals are present in sufficient quantity to react with dyes or even with fibers. These contaminants include oxides of nitrogen, ozone, sulfur dioxide, carbon monoxide, hydrocarbons from gasoline combustion, various peroxides of hydrocarbons, and in addition there may be industrial acid fumes. The action of these chemicals upon dyes is increased where there is high humidity. Combinations of chemical action with the photochemical action of light could further accelerate dye fading.

The Committee on Colorfastness of Textiles to Atmospheric Contaminants is focusing its attention on this relatively unknown area of fading. We are establishing, by research methods, a body of information which will help the dyer and the converter to supply fabrics that will not fail in consumer performance. Should this study show additional causes for change as yet only suspected, test procedures will be developed which will enable the dye manufacturer to make recommendations for dyes and processes which will overcome such fading.

Historically, the first function of the Committee was in a study of the atmospheric fading due to oxides of nitrogen present in the air to the extent of .3 to .5 parts per million. This fading of dyes occurs largely in cellulose acetate but can also occur on nylon and polyester. It can be counteracted by the use of inhibitors. The use of gas-fast blues will minimize complaints due to this type of fading.

It is found, however, that fading took place even on gas-fast blues. This phenomenon (*1*), brought to the attention of the Committee, resulted in a study of the effect of ozone present in the air to the extent of five parts per one hundred million. This ozone concentration is sufficient to cause serious degradation of rubber. A test method which evaluates improved dyeing, and use of special inhibitors have been recommended in the problem of ozone fading.

The Committee was encouraged to examine the effect of atmospheric contaminants due to the puzzling results obtained by the Lightfastness Committee in the exposure of its fabrics to sunlight in various locations. The variations in behavior have been noted not only in the United States but also in France by Niederhauser (*2*). Sunlight exposures in the industrial city of Manchester, England, have not checked with those in Bombay, India, on wool, nylon and cotton.

In a paper presented before the Piedmont Section by Schmitt (*3*) on variables affecting lightfastness, mention was made of the results of exposures in Florida, Arizona, and Los Angeles, Calif, of a group of dyes. Mr Schmitt has given the Committee access to the exposed samples. It is noted that certain dyes on cotton fade when exposed in covered test frames out of contact with light. In these test frames there is access to the atmosphere. As an example, CI Direct Blue 76 shows considerable change. The change is quite pronounced in Los Angeles during a test period of 24 days. On the other hand, there are many dyestuffs, such as CI Direct Blue 104, which do not change during the same period. A similar case where selection of dyes may be employed is that of CI Direct Blue 86, which fades noticeably, whereas Pyrazol Fast Turquoise FBL shows no serious change.

There are other well-authenticated cases of dye change due to atmospheric exposures:

a) Fiber-reactive dyes have been known to change on atmospheric exposure.
b) H E Millson has carried out exposure tests away from light on a number of wool dyes which have shown change. It is known that certain wool dyes change more rapidly when a fabric is left acid during light exposure.
c) There are certain vat dyes which are known to change shade in gas-fired dryers and this has given trouble in consumer performance.

The problem of the effect of atmospheric contaminants is not new and we are indebted to W D Appel, who has called attention to the work done by the AATCC Lightfastness Committee as early as 1928 (*4*). He has also pointed out a reference to the effect of sulfur dioxide on degradation of cotton in the industrial New England atmosphere of 1930 (*5*).

It is this evidence of atmospheric change in dyes which has led the Committee to set up an exposure program of various types including disperse dyes, acid dyes, cationic dyes, direct dyes, vats, sulfurs and fiber-reactives. The dyed fibers include cotton, wool, nylon, polyester, acrylic and acetate. It is gratifying to note the cooperation which has been received from both the fiber manufacturers and dyestuff suppliers in their response to requests for dyed samples. The dyed samples, totaling 68 in number, include dyes for which anomalous behavior has been reported by the members of our Committee, and we are indebted again to Mr Schmitt and to Dr Millson for their suggestions.

The fabrics will be exposed in the industrial atmosphere of Chicago through the courtesy of Atlas Electric Devices Company with arrangements made by J E Norton; in the smog atmosphere of Los Angeles, the facilities of the Geigy Laboratory were offered by Mr Allison. The fabrics will also be exposed in sunlight exposure stations in Florida and Arizona, which represent a hot, moist atmosphere as compared with a hot, dry atmosphere. They will be exposed for periods up to three months at which time we will have information as to which dyes are susceptible. The next step would be to determine what factors are responsible, including those contaminants already specified.

The Committee has already received information as to cases of unexpected behavior of dyed fabrics on exposure. It welcomes further information, as well as suggestions, from members of the AATCC in order to bring this project to its maximum usefulness.

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(1) Salvin, V S, and Walker, R A, *Textile Research J* 25, 571 (1955).
(2) Niederhauser, J P, *Teintex 20*, 673 (1955).
(3) Schmitt, C H A, "Lightfastness of Dyestuffs on Textiles", *Am Dyestuff Reptr 49*, P974-80 (Dec 12, 1960)
(4) Cady, W H, Smith, W C, and Appel, W D, *ibid 20*, 203-24 (June 8, 1931).
(5) Wilkie, John D, *J Research NBS 6* (1931).

Northern Piedmont Section———

CONTINUOUS SODIUM CHLORITE BLEACHING*

R L HOLBROOK, J F SYNAN and W W NORTHGRAVES

Chemicals Div, Olin Mathieson Chemical Corp, Baltimore, Md

THE purpose of this presentation is to describe the development of a new bleaching process in one textile mill.

We feel very optimistic about the results obtained with this development and the future prospects. Textone (sodium chlorite 83%) has long been recognized as an ideal bleaching agent for cellulosic and other fibers because of its ability to achieve maximum bleaching with no fiber degradation. Corrosion and odor problems have limited the use of sodium chlorite in the textile industry since highly specialized equipment has been required. Equipment of this type does not lend itself to the high speed of continuous operation required by the textile industry in the United States. As a result, the original application of sodium chlorite was primarily in batch bleaching operation. In this operation it was proven to be a superior bleaching agent for both synthetic and natural fibers. In fact, for many of the synthetic fibers it is recognized as the only really satisfactory bleaching chemical.

Olin Mathieson has recently developed a continuous bleaching process that provides the advantages of batch acid sodium chlorite bleaching without odor or corrosion and with little modification of conventional continuous equipment. This process is operating at speeds up to 450 yards a minute (double strand) and gives improved dyeability, increased bleaching versatility, higher fiber strengths, softer fiber handle, and at costs equivalent to or lower than the conventional peroxide bleaching process.

Textone is a stable material which must be activated to become an effective bleaching agent. The important product of the activation is chlorine dioxide. Typical activation in an acid bleaching bath may be represented by:

$$H^+ + NaClO_2 \rightarrow HClO_2 + Na^+$$
$$5HClO_2 \rightarrow 4ClO_2 + HCl + 2H_2O$$

The rates of these reactions depend primarily upon pH, concentration, and to a lesser extent, temperature. A maximum temperature of about 212°F is satisfactory and convenient to maintain. The pH of the bleaching solution *in the fiber* must be below 4. Figure 1 is a schematic of the process.

Conventional operations and processing steps are employed in continuous sodium chlorite bleaching. Ideally, the cloth should be somewhat acidic (pH 3-6) as it enters the sodium chlorite bleaching solution. Where an alkaline step is used and not normally followed by an acid sour, some means must be provided for completely neutralizing the residual alkali. In such an acidification step, the acid concentration required will be determined by the amount of alkali in the goods. After the goods are saturated with the sodium chlorite bleach solution, they are held in the J chute for 30-60 minutes at about 200-212°F and then washed. The acid used for the sour is hydrochloric, sulfuric, nitric, or phosphoric. The sour is essential for two reasons:

1) The pH within the fiber must be below 4 after the goods leave the bleach saturator.

2) The majority of the saturators in the textile industry do not have sufficient liquor interchange to completely insure this pH within the fiber.

One pound of sodium nitrate per pound of Textone is added to the bleaching solution. This prevents corrosion in the saturator and in the bleaching zone of the J chute. At the controlled pH in the saturator there is little or no odor of chlorine dioxide. The pH is maintained in control by the use of an automatic pH controlling device. The continuous sodium chlorite bleaching process can be operated successfully without corrosion in open-end-type J chutes fabricated in entirety from 316 or better stainless steel. We hope that some day we can operate in 304-stainless-steel J boxes but for the present this is not possible.

In the continuous process, vapor-phase corrosion initially posed a problem at the delivery end of the J chutes. This was overcome by installing a vapor barrier at the U of the J chute. This is illustrated in Figure 2. Cold water is introduced continuously, and a standpipe overflow maintains the water level constant at the bottom of the J chute. The standpipe or other suitable overflow devices must be sufficiently high to assure that the U of the chute is full. The installation and operation of this water sump arrangement on a bleaching J chute prevents chlorine dioxide vapors from reaching the delivery end of the J chute. Any chlorine dioxide which is retained in the cloth from the bleaching area is dissolved in the water of the U of the chute. The continuous introduction of cold water countercurrent to the cloth flow, with overflow of water through the standpipe, prevents any build-up of chlorine dioxide in solution. This precludes the possibility of having chlorine dioxide gas in the delivery end of the chute and thereby eliminates any vapor-phase corrosion problem.

Vapor-phase corrosion or odor problem on the entry into the chute is controlled by carrying in a high liquor content with the goods and maintaining a cold cloth plug on the top end of the J chute. Steaming is done in the bottom heater only and is controlled so that the maximum temperature in the J chute is 215°F. Desuperheated steam is used for heat supply. The results of extensive test programs comparing sodium chlorite with other bleaching systems have demonstrated many advantages of this process.

Based on our experience with mills we have been working with, the advantages in order of importance can be represented as follows:

1) *Dyeing.* Because of the basic fact that one eliminates sodium silicate in the bleaching formula, one completely eliminates all dyeing resist problems associated with that silicate. Based on many millions of yards of bleaching and dyeing after bleaching, we have not been able to

*Presented by R L Holbrook before the Northern Piedmont Section on October 7, 1961 at Roanoke, Va.

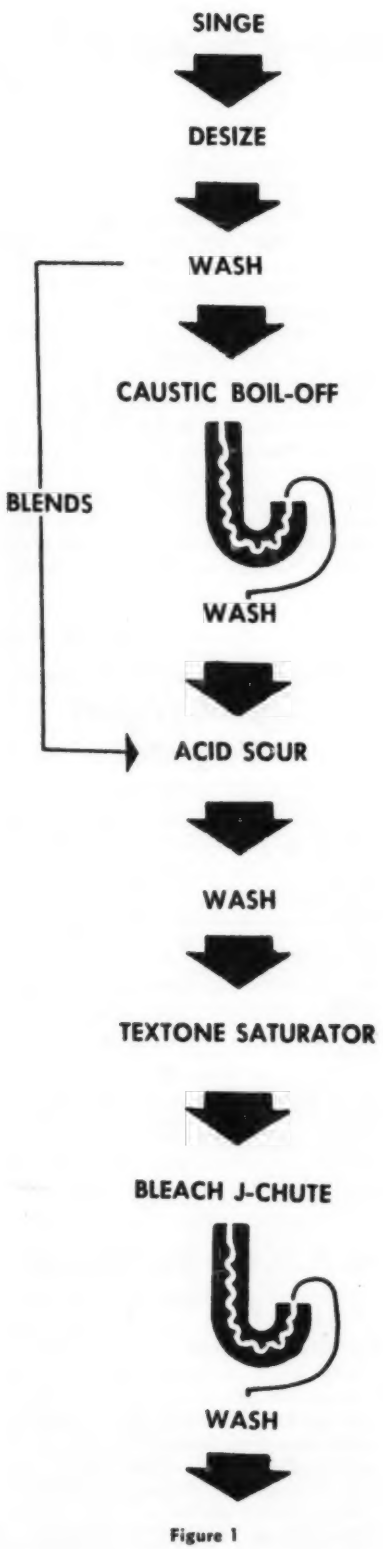


Figure 1

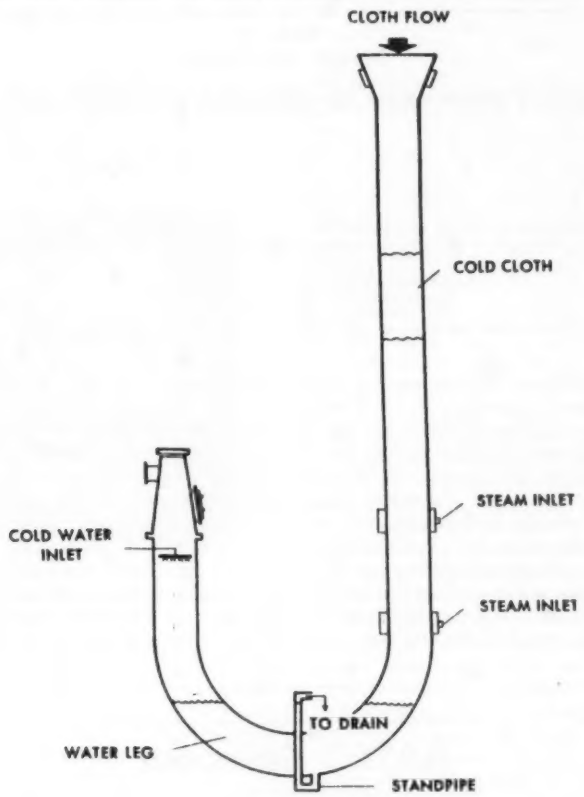


Figure 2

detect any chemical resist problem on dyeing bleached goods. The impact of this advantage has been increased due to the advent of the new fiber-reactive dyes.

2) *Versatility.* As stated earlier in this paper, sodium chlorite is the only satisfactory bleaching chemical for many of the man-made fibers. In fact, there are many fibers that can be bleached only with sodium chlorite. It is possible with this process to bleach continuously any of the fibers that can be rope bleached. Table I gives a list of all the synthetic fibers and their blends with cotton that we have bleached with this process.

It is interesting to note that the market prognostication is toward intic fibers and blends of them with cotton. It is expected that, with this increase, a need will be even more evident for a continuous bleaching process such as we are describing.

TABLE I

Dacron/cotton
Creslan/cotton
Verel/cotton
Cupioni/cotton
Zefran/cotton
Dacron/viscose/cotton
Nylon/Dacron/cotton
Acrilan
Polynosic rayon
Rayon
Cotron
etc

3) *Tensile and tear strength.* The results of extensive tests comparing sodium chlorite with peroxide show better tensile and tear strengths achieved with sodium chlorite over a wide range of cloth weight. Typical results are given in Table II. It is evident from these data that greater tensile and tear are obtained and are maintained even after resination. The results of this advantage of course are becoming more and more important due to the increased production of resin-treated fabrics in the textile industry.

4) *Handle.* In general, fabrics bleached with sodium chlorite have a softer hand than do fabrics bleached by the peroxide systems utilizing silicate.

5) *Economics.* Three major cost comparisons have been made comparing chemical usage for the con-

TABLE II
Strength Comparisons

Fabrics	Tensile strength (lbs) Sodium chlorite	Tensile strength (lbs) Peroxide	Tear strength (gms) Sodium chlorite	Tear strength (gms) Peroxide	Remarks
80x80-4.00 W	64	57	947	696	Before resination
F	55	49	721	501	
104x58-4.38 W	70	67.5	——	——	Before resination
F	33.5	27.5	——	——	
80x56-4.60 W	——	——	1120	861	Before resination
F	——	——	735	464	
124x72-1.80 W	98.7	81.2	2431	2219	After resination
F	66.7	52	1981	1813	
Range of broadcloths	Based on samples taken from a four-million-yard trial, sodium-chlorite-bleached cloth showed an average of four pounds increased filling tensile strength				After resination

General average based on all data obtained:
Tensile strength — 10% Increase
Tear strength — 20% Increase

TABLE III
Economic data

Study	Sodium chlorite 1	Sodium chlorite 2	Peroxide
Yards	334,770	21,560,880	1,454,932
Pounds	81,282	5,486,229	361,648
Usage, %	0.24	0.30	0.38
Cost/# goods *(chemicals, $)	0.001269	0.001583	**0.002008

*Sodium chlorite plus sodium nitrate
**Peroxide plus sodium silicate

tinuous sodium chlorite process with conventional continuous peroxide processes. Table III gives the comparison of two of these studies based on millions of yards of fabrics bleached. The third study is a basic study involving an estimate on the chemical savings for one bleaching range operating the continuous sodium chlorite process. This figure was established at $200 per week chemical savings or roughly $11,000 per year per range. The data from the table, as you can see, involve figures calculated from trials of roughly one-half to 22 million yards of bleaching. In both cases, sodium chlorite showed improved cost savings over the peroxide system.

6) *Operation advantages.* Because we use no silicate, we need no silicate cleaning operations. What this means is that the fabric can be left in the J box at the end of a week's operation, which leaves the equipment in such a state that subsequent starting up does not involve filling the J chute. This gains roughly four hours of production time per week.

In summation, based on development in one textile mill, it appears possible that we can offer to the textile industry a new bleaching process which includes all the advantages of sodium chlorite, such as dyeing, versatility, improved fabric strength, hand, operating, and economics that can be operated on a continuous basis with little modification to conventional continuous bleaching equipment.

AATCC Calendar

COUNCIL; NATIONAL COMMITTEES
Jan 24-26 (Hotel Commodore, New York, NY); Jan 24-25 (administrative and research committees, ECR, TCR, Executive Committee); Jan 26 (Council—10 am)
Apr 12-13 (Francis Marion Hotel, Charleston, SC); Council, administrative and research committees

NATIONAL CONVENTIONS
Nov 14-17, 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); Oct 30-Nov 2, 1963 (Boston, Mass); Sept 24-26, 1964 (Hotel Statler, New York, NY); Oct 14-16, 1965 (Conrad Hilton Hotel, Chicago, Ill); 1966 (Chalfonte-Haddon Hall, Atlantic City, NJ)

HUDSON-MOHAWK SECTION
Jan 12 (Barney's Restaurant, Rt 30, Amsterdam, NY——Topic: "Historical Aspects of Dyeing and Finishing", Sidney M Edelstein, Dexter Chemical Corip); Mar 9 (Chelsea House, Tribes Hill, NY——Topic: "New Advances in Machinery for Pressure Dyeing of Synthetic Fabrics", Fred Fortess, Celanese Fibers Co); May 25 (Jack's Restaurant, Albany, NY——Topic: "The Application of Scotchgard Oil & Water Repellent to Textile Materials", Edwin S Grajeck, Minnesota Mining & Mfg Co); June 22 (14th Annual Outing & Golf Tournament, Antler's Country Club, Amsterdam, NY)

METROPOLITAN SECTION
Jan 19 (New York, NY—"Costs", D M Lewis, Colonial Piece Dye Works); Feb 16 (New York, NY); April 13 (Ladies Night—Margaret Ingersol, *Vogue*); May 18 (Kohler's Swiss Chalet, Rochelle Park, NJ—"Nonwovens—Dyeing and Finishing", panel); June (Outing)

NORTHERN NEW ENGLAND SECTION
Jan 19 (Woodlawn Country Club, Newton, Mass)

NORTHERN PIEDMONT SECTION
Jan 12 (Starmount Forest Country Club, Greensboro, NC); Mar 24 (Sir Walter Hotel, Raleigh, NC)

PACIFIC NORTHWEST SECTION
Mar 17, June 9, July 28 (annual outing); Nov 17 (business meeting)

PALMETTO SECTION
Jan 20-21 (Poinsett Hotel, Greenville, SC); April 14-15, 1962 (Francis Marion Hotel, Charleston, SC)

PIEDMONT SECTION
Jan 27 (Hotel Charlotte, Charlotte, NC); Apr 7 (Hotel Barringer, Charlotte, NC); June 8-9 (1962 Outing—Mayview Manor, Blowing Rock, NC); Sept 29, 1962 (Hotel Barringer, Charlotte, NC)

SOUTH CENTRAL SECTION
Jan 12 (Wimberly Inn—Ladies Night); Apr 7 (Nashville, Tenn); July 20-21 (Annual Summer Outing—Lakeshore Lodge, Chickamauga Lake, Chattanooga, Tenn); Sept 15 (Knoxville, Tenn)

SOUTHEASTERN SECTION
Feb 10 (Opelika, Ala); Mar 31 (Ida Cason Callaway Gardens, Pine Mountain, Ga); June 8-10 (Annual Outing—Radium Springs, Ga); Sept 15 (Atlanta, Ga); Nov 14-17 (National Convention—Biltmore Hotel, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Mar 16 (technical meeting and informal dinner); May 18 (ladies night and dinner dance); June 8 (annual outing); Sept 14 (plant visitation and informal dinner); Oct 26 (election of officers and informal meeting); Dec 7 (technical meeting and informal dinner)

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks may be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

61-30
Education: Illinois Inst of Tech, Chicago. (No degree, but equivalent)
Position desired: Technical sales (sales manager)
Location: Philadelphia base; willing to move south in few years
Age: 46; married; three dependents; references

61-31
Education: HH Maristas, Havana, Cuba; La Salle Extension University; "Longfellow School", Cambridge, Mass
Position desired: Manufacturer's representative, or salesman
Location: Anywhere, since unemployed due to Cuban situation
Age: 43; married; three dependents; references and letter with particulars.

AATCC—Deceased

Member	Section
ROBERT F DEESE RFD #2 Glen Mills, Pa	DV
THOMAS A MARLOWE Marlowe-Van Loan Corp High Point, NC	NPI
C B HAYES Montgomery Drive Spartanburg, SC	PAL

PRESIDENT'S ADDRESS TO THE WASHINGTON SECTION*

ELLIOTT MORRILL

THANK you Mr Chairman.

Good evening members of AATCC, guests, ladies and gentlemen.

I was delighted when I received an invitation to be with you here tonight, and I very much appreciate the opportunity you have given me to address a few remarks to this Section.

The Washington Section is unique in our AATCC family of sixteen sections. Your section is composed primarily of people directly concerned with science. This is reflected in your standing in AATCC. Of the eighteen Olney Medals awarded for achievement in the field of textile chemistry, three have been presented to members of your section. At the Buffalo Convention, you exceeded yourselves by winning the Individual Membership competition. You were one of the two sections of the entire group that entered a paper in the Intersectional Technical Paper Competiton.

I have come to the conclusion that the numerical size of the Section is not important when it comes to getting things done.

Another interesting feature of your section is the number of lady members and lady officers. This pleases me, for that happy combination of feminine grace and professional achievement adds greatly to our Association.

We, as an Association, are coming to give more and more recognition to the responsbilities we have as a technical and scientific society. It is these responsibilities I would like to discuss for the next few minutes.

We are a sizeable and highly respected member of the community of technical and scientific societies in the United States, and, in fact, the world. We have about 7,500 members, residing in forty-six of the fifty states including Hawaii and members in over forty other countries in all the larger nations and in some of the smaller ones, for example—the Republic of China (Taiwan), Honduras, Lebanon, Thailand, Syria and Uruguay. We have great responsibility to each and every one of our members

ELLIOTT MORRILL

both at home and abroad.

We have a responsibility to our Corporate members which are supporting our technical program with funds and encouraging their people who hold membership in the Association to participate in the Association's activities both at the section and national level. Our obligation to these 300 companies is to utilize effectively their monies that they may reap the rewards of the effort of the Association in advancing the science of textile chemistry from which the industry as a whole is benefitting.

In this community of voluntary, individual membership societies, we have a responsibility to our sister societies and other groups representing segments of scientific effort in our national life. To mention a few, I could name the American Chemical Society, the American Society for Testing and Materials, the Society of Automotive Engineers, TAPPI, and associations such as the National Institute of Drycleaning, the American Standards Association. Further afield and across the ocean, there are our friends in The Society of Dyers and Colourists, the International Federation of Associations of Textile Chemists and Colourists, the International Organization for Standardization and our Canadian neighbors in the two sections of the Canadian Association of Textile Colourists and Chemists.

In addition, there are the civilian and military agencies and departments of the Federal Government to which some of you belong. None of these organizations can subsist in a vacuum or independently, and it is through their cooperative effort and ours, the exchange of information and the pooling of knowledge that is helping to accelerate our national know-how.

Our ultimate responsibility in the broader sense is to the public. This is fundamental to the terms of our charter of incorporation in the Commonwealth of Massachusetts and to the tax-exempt privilege accorded us by the United States Treasury Department. Within this framework, our responsibility is, then, the obligation to serve the public for the common good and in the public interest. Perhaps we could translate this by saying that within the range of our membership is contained a cross-section of the public interest and that if we render essential services to the membership-at-large, consistent with the obligations and responsibilities of the generally accepted concept of a technical and scientific society, we shall be serving the public for the common good.

The primary function of our society, as I see it, is serving as custodian, or trustee, if you will, of an important body of scientific knowledge which must be developed, assembled, coordinated and disseminated both in breadth and depth. May I ask your indulgence to quote from my address on this subject from the Buffalo Convention.

> "Our membership is one of many and diverse interests. The challenge to AATCC to serve these varied interests is great. While they are bridged by a common concern for the health and progress of our industry, they must be recognized for the particular fields they represent and the special problems which confront them. The man in the dyehouse, the chemist, the technical sales and service people, the management groups, the educators, the retailers, the commercial laboratories, the government specialists, the finisher and the foreman; these and many others look to AATCC for information and for knowledge. Unless we can communicate that knowledge to them, we are not serving adequately the broad interests of the membership as a whole.
>
> "We have the tools for develop-

*Presented December 8, 1961 at the Harris Research Laboratories, Washington, DC

ing and assembling this information through our many committees and our sections; but we must improve the machinery to coordinate and disseminate."

You in the Washington Section are doing your part, and doing it well, in helping to keep AATCC at the forefront of technical achievement for which it is noted throughout the world. The national committees of the Association will continue to give you every assistance. We are taking steps to provide you with a broader base of assistance and support in a number of areas. Last month, at its meeting in Chicago, the Council approved a blueprint of a program which we believe will meet a number of needs of our committees, our Sections and our members. Let me tell you briefly what we have in mind.

For over a year, the Executive Committee on Research has been engaged in an intensive study to determine what the research and technical aims of the Association should be and how these aims could best be accomplished. Further emphasis was added when ECR was formally asked by the Executive Committee of the Council to make a study. ECR was assisted in the investigation by the results of an AATCC membership analysis, based on occupational classification. A questionnaire was also used in sampling the membership for ideas as to the lines of activity to be followed by AATCC research efforts.

It was believed by ECR that the primary and most important research aims of the Association should be to continue in the ever-enlarging field in which it already excels and enjoys a unique position of authority—that of developing test methods. The entire textile industry looks to AATCC for up-to-date, standard test methods which are of vital importance to the industry. It should be pointed out that AATCC has a dynamic and growing research program in this area, represented by 63 committees with active members drawn from 150 companies. AATCC has just published its 100th test method which is supporting proof of the Association's prime area of interest.

In order to accomplish our objectives as we see them, we plan to do a number of things. For example, we need more effective coordination and supervision of research committee projects. We need to organize seminars, symposia and study groups at both the national and sectional levels. We need to maintain closer liaison with our corporate members and study areas where AATCC research can be of even greater value to the industry. We need to better coordinate and expand AATCC's activities with other technical associations and other groups where a common interest exists.

We need the kind of laboratories at our National Headquarters which can be used for periodic checking of test methods and standardization of new equipment and test aids, and a place where our members can come for demonstrations as to the methodology of AATCC tests. To assist in achieving these objectives, we are strengthening our technical staff by adding a technical director and a textile chemist to our national headquarters organization. The Executive Committee on Research is continuing to study the Association's technical aims and objectives, and we expect to come forward with further recommendations in the future.

I hope I have been able to convey to you this evening a picture of some of the things we are trying to do and what we are doing to accomplish our objectives. I wish to thank your officers for the privilege they have given me of being with you tonight. My thanks to all of you for your generous reception.

'62 CONVENTION COMMITTEE CHAIRMEN NAMED

COMMITTEE chairmen for the 1962 AATCC Convention, to be held under the sponsorship of the Southeastern Section November 14-16 at the Atlanta Biltmore Hotel, Atlanta, Ga, have been named as follows:

Executive Committee
John C Cook, chairman
Textile Industries
Atlanta, Ga

H Gillespie Smith, cochairman
American Cyanamid Co
Chamblee, Ga

A Kempton Haynes, cochairman
Rohm & Haas Co
Atlanta, Ga

Dining
Robert B Hallowell
Coats & Clark, Inc
Albany, Ga

Entertainment
J Elwood Barbre
Pepperell Mfg Co
Opelika, Ala

Exhibits
Francis X Nerney
Becco Chemical Div
Atlanta, Ga

Finance
William E Fayssoux
Royce Chemical Co
Decatur, Ga

Hotel and Reservations
Edward R Ravenel
Morton Salt Co
Decatur, Ga

Ladies
William B Griffin
Dexter Chemical Co
Atlanta, Ga

Printing
Robert K Federal
General Dyestuff Co
Columbus, Ga

Publicity
George H Dockray
Textile Industries
Atlanta, Ga

Reception
John J Barnhardt, cochairman
E I duPont de Nemours & Co, Inc
Atlanta, Ga

Ralph Taylor, cochairman
Charles S Tanner Co
Columbus, Ga

Registration
Carl R Blumenstein
Seydel-Woolley & Co
Atlanta, Ga

Technical Program
Max Ferguson, cochairman
National Aniline Div
Atlanta, Ga

J David Reid, cochairman
Southern Regional Research Lab
New Orleans, La

Tours and Transportation
Joe Richardson
Russell Mfg Co
Alexander City, Ala

Activities of the Local Sections

Delaware Valley

(Submitted by Frank A Mather, Nov 20, 1961)

THE Delaware Valley Section held its second meeting of the fall at Beck's-on-the-Boulevard, Philadelphia, Pa, on October 27. This meeting was designated as Corporate Membership Night. Prospective Corporate Members were invited to attend and all of the Section's 41 Corporate Members were invited to send representatives as guests. Response was good, with 155 members and guests in attendance.

Chairman Clarence Seibert extended greetings to the audience and introduced Elliott Morrill, AATCC president. Following his opening remarks, Mr Morrill introduced Charles A Sylvester, chairman of AATCC's Executive Committee on Research. In his talk, entitled "AATCC Research at the National Level", Mr Sylvester repeated a point he has made before . . . "Too often we tend to take a good thing for granted, and AATCC is a good thing. Its test methods are an integral part of the textile industry. Sometimes I wonder if we really appreciate the fact that practically all of the dyes, finishes and many chemicals produced in the United States are controlled and checked by the use of AATCC test methods. And these same AATCC test methods are a major factor in insuring the satisfactory consumer performance of the billions of yards of textiles that find their way across the retail counter and into the hands of Mr & Mrs United States."

Seated, l to r: Charles A Sylvester, Elliott Morrill, George S Wham. Standing, l to r: Richard Landry, Graham M Richardson, Victor S Salvin, Albert C Nuessle

At the conclusion of his remarks, Mr Sylvester introduced George S Wham, chairman of AATCC's Technical Committee on Research, who served as moderator for the evening. Dr Wham's panelists consisted of Albert C Nuessle, chairman, Committee on Damage Caused by Retained Chlorine; Graham M Richardson, chairman, Committee on Wash and Wear; Victor S Salvin, chairman, Committee on Colorfastness of Textiles to Atmospheric Contaminants; and J L Richard Landry, who spoke in place of Hugh R Davidson, chairman, Committee on Color.

Counterclockwise: Clarence A Seibert, D V Section chairman; Elliott Morrill, president, AATCC; Edward G Haack, D V Section vice chairman; Victor S Salvin, chairman, TCR Committee on Colorfastness of Textiles to Atmospheric Contaminants

William S Sollenberger (left), AATCC vice president, Central Atlantic Region; George P Paine, executive secretary

•

Piedmont Section Hosiery Division

THE first official meeting of the newly formed Hosiery Division of the Piedmont Section will take place Saturday, January 27, at the Hotel Charlotte, Charlotte, NC.

Presiding will be G Parks Sherrill Jr, Alba Hosiery Mills, who will outline the objectives of the new Division formed to aid hosiery men in their common problems.

Following an open discussion among the members, a panel discussion will take place. It will be moderated by Vaughn Boone of Geigy Dyestuffs. Panelists will be W W Gluyas, Adams-Millis Corp; D B Norton, Sandoz, Inc; M Wilson, Chadbourn-Gotham, Inc; and Lee Parham, High Point Chemical Co.

Officers of the new Division, in addition to Chairman Sherrill, are James Fogleman, Kayser-Roth, vice chairman; Fred Munday, Marlowe-Van Loan, secretary; and Ernest Burrell, Huntley Hosiery Mills, Inc, treasurer.

Members of the Steering Committee include Rufus Smith and M Wilson of Chadbourn-Gotham, Inc; J Thomas Lindley of W F Fancourt Co; Henry Dixon of Burlington Hosiery Co; Charles Clapp of Baker-Cammack Hosiery Mills, Inc; and Vaughan Boone of Geigy Dyestuffs.

An all-out drive to bolster attendance is underway.

•

Hudson-Mohawk

(Submitted by Anthony Cassetta, secretary, Nov 20, 1961)

THE Hudson-Mohawk Section held a meeting November 17, 1961, at Jack's Oyster House, Albany, NY, with 53 members and guests in attendance.

B Collins of Nopco Chemical Co was scheduled to speak on "Polyurethanes and their Application to Textiles". Due to flight difficulties, Mr Collins was unable to attend and John C Moessinger, formerly with General Aniline & Film Corp, and now retired, graciously consented to address the group.

Dr Moessinger's talk was in the form of a travelogue of his trip to Switzerland, Holland and Venice. The group enjoyed his color slides and his enlightening comments of Europe.

Chairman Bill Mafilios conducted a brief business meeting and Ladies Night chairman Al Rooney gave a progress report.

•

Pacific Southwest

PACIFIC SOUTHWEST Section held its 1961 Annual Outing at Rancho Santa Fe, Calif, on October 7 with approximately 60 members and guests in attendance.

John Smith, Dyemasters, Inc, served as chairman of an outing committee which included James Leonard, Catalin, Inc, prizes; Edwin Lindquist Jr, Geigy, Inc; Robert Mishell, Dyemasters, Inc, awards; and Joseph De La Barre, Sandoz, Inc, golf. Others aiding the Committee were: Mr & Mrs F Wilhelm, reception; Mrs T Lee, tennis; Mrs P Noonan, shuffleboard; Mrs D Sanders, swimming; R Demuth, ladies putting; Mrs J Smith, men's putting; N Chloris, ping pong; Mrs R Fliegel, follies; A H Roberts, programs; and C Platz, cover.

Award winners were as follows:

Golf—R Mishell, Dyemasters, Inc, low gross; J Smith, Dyemasters, Inc, second low gross; W Brant, General Dyestuff Co, low net; J Connell, Nopco Chemical Co, second low net; E Lindquist, Geigy Dyestuffs, "nearest the pin"; V Boutin, Carbic-Hoechst Corp, longest drive; H Miller, Geigy Dyestuffs, most eights; R Akins, Nopco Chemical Co, most sevens; N Garrett, National Aniline Div, men's putting; L Roberts, ladies putting.

Ping Pong—P Noonan

Shuffleboard—F Celiberti, Naugatuck

Tennis—S Springer, Springer Co

Swimming—C Noonan.

Northern Piedmont

(Submitted by Rodney L Coleman Jr, November 3, 1961)

THE inaugural meeting of the Northern Piedmont Section was held at the Hotel Roanoke, Roanoke, Va, October 6-7. There were 196 registrations. Attendance at the technical sessions and the business luncheon was encouraging.

On Saturday morning, a panel discussion on bleaching was conducted by Messrs Leon Moore, DuPont; R L Holbrook, Olin Mathieson; and B K Easton, FMC Corp.

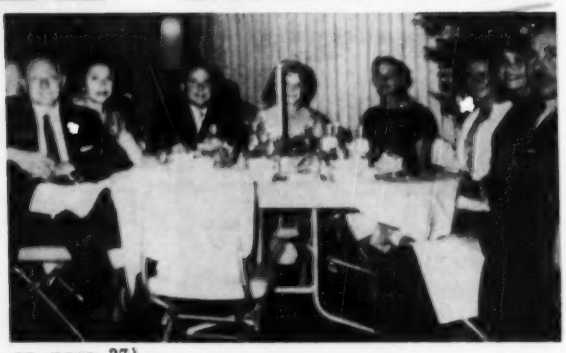
Following the morning session, a business luncheon was held. Among those recognized at the head table were Elliott Morrill, AATCC president; Henry Gaede, vice president, Southern Region, and George Paine, executive secretary.

The afternoon technical session was preceded by an attraction emanating from Crosley Field, Cincinnati, O. Following this, J Wegmann of Ciba Company presented a paper on the soaping of vat colors.

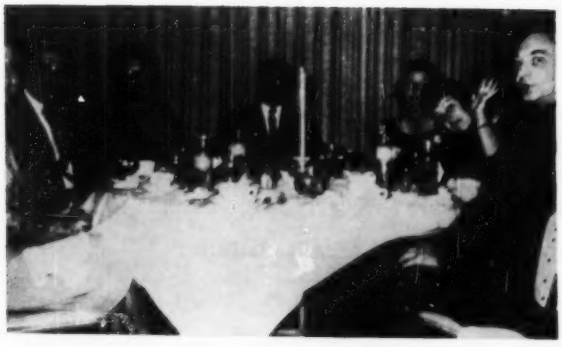
The meeting ended with a social hour after the final technical meeting.

PACIFIC SOUTHWEST SECTION OUTING • OCTOBER 7, 1961
RANCHO SANTA FE, CALIF

(Photos courtesy of Victor Boutin, Sidney Springer and Norman Garrett)



(Additional photos on page 37)



Western New England

(Submitted by W H Espelin, secretary)

THE 1961 Annual Meeting of the Western New England Section was held Friday evening, October 27, at Rapp's Restaurant, Shelton, Conn, with 30 in attendance.

Main order of business of the evening was the report of a Nominating Committee, consisting of Paul Reeves, chairman; Ernest Otto, H DeMarco, L O'Connell, and P Morin; and the election of officers for 1962 as follows:

Chairman — Timothy J Horan, Princeton Mills

Vice chairman—William H Espelin, Ciba Co, Inc

Secretary—Joseph A Black, American Cyanamid Co

Treasurer — Burton C Winkler, American Fabrics Co

Councilors—Thomas J Gillick Jr, American Felt Co; Albert H Rant, Laurel Soap Mfg Co, Inc

Sectional Committee—Walter R Simpson, Lockwood Greene Eng, Inc; Arthur Bibeau Jr, American Felt Co; Gregory J Pelliccione, Princeton Mills; Peter DuBiel, C[illegible]ney Bros, Inc

Other business included a report by Mr Gillick on the activities of the National Council, reports by the Outing and Membership Committees, and the treasurer's report.

IMPORTANT NOTICE

To all manufacturers of Dyes, Pigments, and Resin-bonded Pigment Colors:

To all manufacturers of Textile Chemical Specialties:

The Sections on Dyes and Pigments, Resin-bonded Pigment Colors, and Textile Chemical Specialties in the AATCC *Technical Manual* will be completely revised and brought up to date in the 1962 edition.

Directions for the submission of information and the necessary forms have been mailed to companies whose products were listed in the 1961 edition. If you have not received this material or wish to have your products included in 1962 please notify the undersigned. The material will be sent to you promptly.

To have your products included in the 1962 *Technical Manual* the information we are requesting must be received by the undersigned before the dates given below.

DEADLINES

For Textile Chemical Specialties	January 10, 1962
For Dyes and Pigments	January 20, 1962
For Resin-bonded Pigment Colors	January 30, 1962

William D Appel, Editor, *Technical Manual*
9101 Jones Mill Road, Chevy Chase 15, Maryland

Elected to Membership

No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
* indicates transfer from another class of membership.

November 30, 1961

NEW ENGLAND REGION

Northern New England Section

Alvin O Ramsley
*Edward E Richard**

CENTRAL ATLANTIC REGION

Hudson-Mohawk Section

Robert A McWilliams

SOUTHERN REGION

Washington Section

*Edith Maier Singh**
*Ted E Hager**

Piedmont Section

Dan G Amick

Northern Piedmont Section

Cecil Brenner
Garland E Earhart
Reginald B Gillespie
Byron H McNeil
Allan C Spearman

Southeastern Section

Alex A Scarborough

South Central Section

Lewis S Rubin
*David F Smith**

WESTERN REGION

Mid-West Section

William A Holland
Donald J Bannon (J)

Pacific Southwest Section

*Joseph Rothway**

STUDENT CHAPTERS

Bradford Durfee College of Technology

Leonard M Ansin (S)
Kenneth D Langley (S)

Clemson College

Roy E Phillips (S)
Jerry N Pruitt (S)

Lowell Technological Institute

Manikant R Shah (S)

●

December 13, 1961

NEW ENGLAND REGION

Northern New England Section

John G Barbour
Richard T Eklund
Edward A McLeod
*Muriel Angelil**
*Joseph F Bradley**
*Allen A Gwinell**
*Miriam M S Liang**
*John L Nicalek**
*Richard L Pepin **

Western New England Section

Lawrence Kogan
*Thomas H Bolcer**
*Richard C Newton**

Rhode Island Section

John J Heard
Lewis A Prescott
*Benjamin E Wooding**

CENTRAL ATLANTIC REGION

Metropolitan Section

Fred W Nuss
Bartholomew W McDonell (A)
Robert B Murray (A)
Herman A Nagel (A)
Daniel P Shannon (A)
Hellmut E Luecker (J)
*Guy N Thompson Jr**
*Richard M Axtell**
*Nick J Christodoulakis**
*Gerald T Gallagher**
*James L Gleim**
*Paul A Harrington**
*Lawrence W Healy**
*Jack G Irving**
*Edwin A Johnson**
*Richard C Jordan**
*Guy D Moulton**
*Elliott Nelson**
*Eugene M Posniak**
*John L Twarog**

Hudson-Mohawk Section

Herman J Bryan
George C Riley
Thomas J Sakiewicz (A)
*Ronald P Chaves**
Louis M Wozniak Jr

Niagara Frontier Section

Fred W Clark
Leonard J Phelan
Donald W Seebohm
Russell I Steiner
*Maurice Graham**

Delaware Valley Section

John E Baxter
Jan Z Sasowski
Ernest Vogt
*Antonio N Aleixo Jr**
*Stanley B Berman**
*Albert J Grunfeld**
*Theodore M Houseknecht**
*Raymond V Kusiak**
*Charles E Zortman**

SOUTHERN REGION

Washington Section

*Bernard G Kidda**

Piedmont Section

James H Austin
Thurston D Carroll
Archie G Schoonoser
Prem P Singh
*Charles E Daniels**
*Victor H Garrou**
*Theodore A Jeffords**
*Joel P Kendrick**
*Charles R Lewis**
*John W Nix**
*Vincent T Novak**
*Samuel G Parler**
*William Spier Jr**
*Frank J Venskunas Jr**
*Frederick M Warlick Jr**
*Daniel D Ward**

Northern Piedmont Section

Lawrence J Branch
Beryl M Kuhn
*Richard B Gunter**
*James H Lockamy Jr**
*Gary McVey**

Palmetto Section

*Herbert F Ross**
*Duane I Alewine**
*Willie E Alford**
*Bobby J Bailey**
*Kenneth L Brewton Jr**
*Artimus R Brinson**
*William M Campbell Jr**
*William P Gibert**
*Floyd A Goodwin**
*John R Newell Jr**
*Charles H Patrick Jr**
*Dennis E Pike**
*Ervin R Poole**
*Richard S Powell**

South Central Section

Ronald J Richardson
Hunter S Woodbery (A)
*Raymond Bertani**
*George H Corn**
*Thomas W Woolsey**

Southeastern Section

*George W Butler**
*Reginald A Fujimoto**
*Eugene Hannah**
*Jesse C Yow Jr**

WESTERN REGION

Mid-West Section

Thomas E Ludwig
William W Lane (J)
*Daniel J Barufaldi**
*Victor C Braun**
*Roy Serpa**

Pacific Southwest Section

*Eugene Kim**
*Anna R Tyson**

STUDENT CHAPTERS

Georgia Institute of Technology

Mack H Baker (S)
Winston W Wells (S)

Lowell Technological Institute

Prem P Amin (S)
Ashwin V Chiniwalla (S)

AT LARGE

Vasant B Chipalkatti
William D Sherren
Angelo Barzaghi (A)
Vishnu Kumar Nankani (J)
James U Dy (S)
Bun-Seng Tan Ong (S)
*Shirish B Mehta**
*Sheriar S Mistry**
*Ode F Kattan**
*Jean B Letourneau**
*Manuel A Mercado**
*Angel U Perales**
*Samuel H Swint Jr**
*Carlos V Uribe**
*Marcos Wasserman**

Membership Applications

November 23—December 9, 1961

NEW ENGLAND REGION

Rhode Island Section

Senior

Matthew S Widor—Colorist, Colony Textile Printing Co, Woonsocket, RI. Sponsors: J Coupe, J Pilkington.

CENTRAL ATLANTIC REGION

Delaware Valley Section

Senior

William R Britton—Technical rep, Union Carbide Chemicals Co, Moorestown, NJ. Sponsors: W H Bertolet 3rd, G E Prime.

George E Simpson—Dyer, H Warshaw & Sons, Milton, Pa. Sponsors: P Moran, J D Farrell.

Junior

Lloyd C Wimer Jr—Dyeing & finishing tech, Joseph Bancroft & Sons Co, Wilmington, Del. Sponsors: R E Mattson, A Prucino.

Transfer to Senior

Charles E Zortman—Lab tech & salesman, Geigy Chem Co, Philadelphia, Pa. Sponsors: F W Allendorf, K E Schmalenberger.

Hudson-Mohawk Section

Senior

Franklin W Springer Sr—Foreman dyer, Palatine Dyeing Co Inc, St Johnsville, NY. Sponsors: H L Dunlap, A G Tompson.

Transfer to Senior

Ronald P Chaves—Res engr, Mohasco Industries Inc, Amsterdam, NY. Sponsors: A Cassetta, F J Szurek.

Metropolitan Section

Senior

Charles J Lattarulo—Chemist, Interchemical Corp, New York, NY. Sponsors: S Meeker, L G Blomquist.

Nancy Ann Lillyman—Dir of quality control & bureau of standards, Fruit of the Loom Corp, New York, NY. Sponsors: G S Wham, E C Ramsay.

Transfer to Senior

Nick Christodoulakis—Tex chemist, Central Research Labs, J P Stevens & Co, Garfield, NJ. Sponsors: W Von Bergen, R E Miller.

E James Stavrakas—Mgr, textile testing labs, J C Penney Co Inc, New York, NY. Sponsors: P J Fynn, E Artim.

SOUTHERN REGION

Northern Piedmont Section

Senior

Mary Lee Wilkins—Chemist, Dan River Mills Inc, Danville, Va. Sponsorms: C L Zimmerman, J B McElveen.

Junior

Fred E Wilson Jr—Chemist, Piedmont Chem Industries, High Point, NC. Sponsors: G P Paine, G J Mandikos.

Transfer to Junior

Bruce A Evans—Mayfair Tricot Co (Burlington Industries), Burlington, NC. Sponsors: P M Wyrick, R F Sherriff.

Palmetto Section

Senior

Chanco C Melton Jr—Vice president, gen mgr, A P McAuley Co Inc, Gaffney, SC. Sponsors: W K Hammett, S Y Stribling III.

Garland S Simpson Jr—Salesman, Consos Inc, Charlotte, NC. Sponsors: J A Wolhar, C J Wolhar.

Piedmont Section

Senior

Margaret E McGeever—Head of home economics dept, Western Carolina College, Cullowhee, NC. Sponsors: G P Paine, G J Mandikos.

Southeastern Section

Senior

Robert L Broom—Asst dyer, Classe Ribbon Co Inc, Anniston, Ala. Sponsors: W Israel, W E Farmer.

James H Knight—Asst supt of dyeing, Pepperell Mfg Co, Opelika, Ala. Sponsors: H L Lanier Jr, C C Lane.

Abram H Kulp—Dyer, James Lees & Sons, Clayton, Ga. Sponsors: R L Merrow, M Jones.

Anthony R Markezich—Physicist (textile testing), U S Dept of Agriculture, SRRL, New Orleans, La. Sponsors: R K Worner, R M Reinhardt.

Junior

Jocelyn C Oubre—Chemist, U S Dept of Agriculture, SURDD, New Orleans, La. Sponsors: R Kullman, R M Reinhardt.

Washington Section

Transfer to Senior

Claudia F Vosbeck—Chemist, National Bureau of Standards, Washington, DC. Sponsors: J M Blandford, M K Wharton.

WESTERN REGION

Mid-West Section

Senior

Edward H Clayton—President, St Louis Finishing Co, St Louis, Mo. Sponsors: G P Paine, G J Mandikos.

Pacific Southwest Section

Senior

Steven Kelen—Supt, California Dyeing & Finishing Co, Los Angeles, Calif. Sponsors: V F Schulz, W Stocker.

Associate

Henry B Little—Vice president, Paramount Flag Co, San Francisco, Calif.

STUDENT CHAPTERS

New Bedford Institute of Technology

Student

David S Rulison—Student, New Bedford Inst of Technology, New Bedford, Mass. Sponsor: F Tripp.

Philadelphia College of Textiles & Science

Student

Philip A Spanninger — Student, Philadelphia College of Textiles & Science, Philadelphia, Pa. Sponsor: W Hughes.

AT LARGE

Senior

Edwin Grob—Production mgr, Societa Bergamasca per L'Industria Chimica, Bergamo, Italy. Sponsors: G P Paine, G J Mandikos.

Hidenaga Yoshimura—Staff member, Toyo Rayon Co Ltd, Otsu-City, Shigan-ken, Japan. Sponsors: G J Mandikos, G P Paine.

Transfer to Senior

Carlos V Uribe—Plant mgr, Pepalfa S A, Medellin, Colombia. Sponsors: G P Paine, G J Mandikos.

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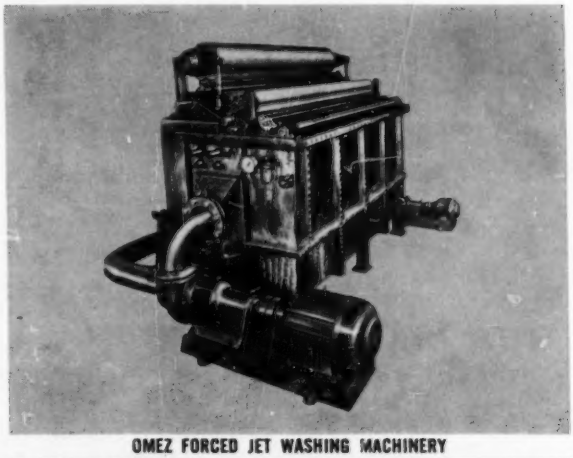

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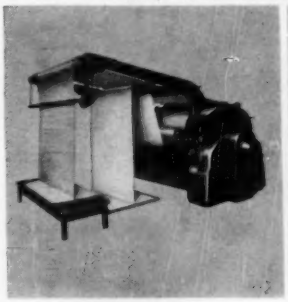

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ADR News Report:

NCSC CONDUCTS FIBER STUDY—Henry A Rutherford (left), head of the Department of Textile Chemistry at North Carolina State College, and Arthur A Armstrong, research associate professor at the College, look over Cobalt-60 source in the college's radiological laboratory, site of a far-reaching study on fiber modification by atomic radiation.

NC State to Continue Fiber Research Project

A $50,664.00 grant has been awarded to the School of Textiles at North Carolina State College to continue for one year a research project dealing with fiber modification through irradiation processes.

Announcement of the receipt of the grant was made recently by Malcolm E Campbell, dean of the college's School of Textiles, and Henry A Rutherford, head of the college's Department of Textile Chemistry.

They said the research project, begun in December, 1958, shows promise of practical benefits to the textile industry through atomic energy and may have world-wide impact through the peaceful utilization of nuclear fission products.

The grant for the continuation of the basic research investigation, which already has produced what is termed a "minor breakthrough" for improving end-use properties in textile fibers, was made to the School of Textiles by the U S Atomic Energy Commission and four textile mills in the Carolinas—Burlington Industries, Cone Mills Corp, Reeves Brothers, Inc, and J P Stevens and Co, Inc.

"The textile industry," said Dean Campbell, "is beginning to realize the importance of basic research and to see the practical results of this specialized phase of our scientific investigations."

With the use of the grant, scientists in the College's School of Textiles will concentrate their efforts on graft polymerization as a means of modifying textile fiber properties.

They will work in the School of Textiles radiological laboratory. Among the facilities with which they will seek the fiber modification is a 4,000-curie Cobalt-60 source. The laboratory also contains a 256-channel radiation spectrum analyser. Physical facilities in the remainder of the college's School of Textiles, which are available to support the project, are valued in excess of $2,000,000.

Senior investigator on the project is Professor Rutherford, who is also director of chemical research. Supervising the work will be Arthur A Armstrong Jr, research associate professor and head of the Radiological Research Section of the Department of Textile Chemistry.

The project is entitled "Modification of Textile Fiber Properties by Radiation-Induced Graft Polymerization."

Purpose of the new studies, according to Prof Rutherford, is "to provide more desirable end-use properties, either functional or aesthetic; the use of grafting would appear to have more value in the functional area.

"For example, 'hard-to-dye' fibers can be made dyeable by the grafting of a substance that has inherent dye receptivity; in the present investigation this has been done by the use of both diallylamine and vinyl acetate on polypropylene fiber. (A patent has been applied for on this process.)"

As the scientists continue their probe of fiber modification by atomic means, they have been encouraged by the recent discovery of "factors that promote good grafting" and are working with the belief that "desirable fiber modification by radiation is not only possible but practical."

The studies will be focused principally on cotton, which constitutes approximately 60 percent of the total textile materials consumed in the United States.

Professor Rutherford pointed out, however, that the State College scientists plan "to look for possibilities, through graft polymerization, of improvement in such things as creep under tension in polyamides, the wet strength of rayon, the softening point of acetate, felting shrinkage in wool, etc.

"In short, where fiber deficiencies exist, means of overcoming them will be investigated."

●

Mount Hope Opens New Plant in Wisconsin

Mount Hope Machinery Co, Taunton, Mass, has opened a new plant in Appleton, Wis, for the manufacture, sales and service of its full line of Mount Hope bowed rolls and other web control equipment for the textile, converting, plastics and paper industries.

James F Ginter, Mount Hope sales engineer for northern Illinois, western Michigan, Wisconsin, Iowa and Minnesota, will move his offices to the plant from their present Chicago location. Mr Ginter has represented Mount Hope in the region since June 1953.

●

Accuracy of pH Standards Increased

The Naitonal Bureau of Standards has extended the accuracy of the seven pH standards (*1*) that define the pH scale from 0 to 95°C. Whereas the pH was formerly certified to 0.01 unit, the values from 0 to 60°C are now considered accurate to within 0.005 unit. This estimate includes 0.003 unit as a limit for the extrapolation, with an allowance of 0.002 unit for possible uncertainties in the electrochemical constants. Above 60°C, the estimated uncertainty is 0.008 unit.

Measurements of the acidity or basicity of solutions, expressed on the pH scale, are of critical importance in chemical analysis, medical research, and many industrial processes. Some years ago the Bureau took the lead in establishing a standard pH scale (*2*) that would meet the practical needs of industry and possess, as well, the fundamental meaning demanded by science. Although standards for the adjustment of pH measuring equipment have been issued by the Bureau for more than 15 years, until recently fundamental difficulties in the calculation of a standard pH limited the accuracy in the assignment of standard pH values to two decimal places.

In general, to assign values to the pH standards, the electromotive force of cells employing the standard solutions as electrolytes is measured. These cells utilize the highly reproducible hydrogen and silver-silver chloride electrodes. Computation of the pH has been based upon several reasonable assumed relationships between ionic activities and mean activities.

During the past year, a mutually satisfactory convention (*3*), developed by the Bureau in cooperation with the British Standards Institution's pH committee, has received the endorsement of the International Union of Pure and Applied Chemistry. This convention defines uniquely the numerical value of the individual activity coefficient of chloride ion in the buffer solutions.

To extend the accuracy of the pH standards, the original emf data have now been re-examined. With the aid of the new convention, the standard reference values of pH from 0 to 95°C have been recalculated with a single consistent set of standard potentials and electrochemical constants.

(*1*) The materials from which the standard pH solutions are prepared are described in NBS Circular 552, Standard Materials. This Circular may be ordered for 35 cents from the Superintendent of Documents, US Printing Office, Washington 25, DC.
(*2*) Standardization of the pH scale, *NBS Tech Bull 31*, 138 (1947).
(*3*) R G Bates and E A Guggenheim, *Pure and Applied Chemistry 1*, 163 (1960).

Cranston Applying Textone Continuous Bleach Process

The first full-scale commercial application of the Textone continuous bleaching process has been announced by the Cranston Print Works Co, Inc, Fletcher, NC.

The new process, developed by the Chemicals Division of Olin Mathieson Chemical Corporation after two years of field work, reportedly provides for continuous bleaching of both synthetic and natural fibers at reduced costs. It is said to eliminate all dyeing problems associated with bleaching, and to produce cloth with higher strengths and softer hand than now possible with conventional bleaching processes.

After extensive mill testing, Cranston has become the first textile company to install the Textone process on an operational basis under a licensing agreement with Olin. The process is currently undergoing production trials in a number of other companies.

Until now, Textone (83% sodium chlorite) has been used principally in batch operations, where, it has been said, it serves as an ideal bleaching agent for cellulosic and other fibers because of its ability to to achieve maximum bleaching with no further degradation. The new process reportedly extends the advantages of Textone to the continuous bleaching of cotton, synthetic fibers and blends, with little modification of existing equipment.

The Textone continuous bleaching process, being patented by Olin, is available to textile mills under a $1 per year licensing arrangement.

●

All Ciba Companies to Merge

Robert Kaeppeli and Victor Umbricht will serve as chairman and president respectively of the new CIBA Corporation effective January 1.

On that same date all CIBA companies will be merged into CIBA Corporation. These companies include CIBA Pharmaceutical Co, Summit, NJ; CIBA Chemical & Dye Co, Fair Lawn, NJ; and CIBA Products Co, Fair Lawn, NJ.

The board of directors of the CIBA Corporation will have the same members as its predecessor organization, CIBA States Ltd, except for the retirement of former chairman, Frank Common, and the election of Albert Wettstein.

The other officers of the corporation are T F Davies Haines, executive vice president; David B Dyche, vice president in charge of finance; Harry B Marshall, vice president; Roderic L O'Connor, vice president and secretary; Clifton S Thomson, general counsel; Karl Zimmerman, controller; and T H Saari, treasurer.

Present operating subsidiaries become divisions of the CIBA Corporation. Mr Haines will continue as president of CIBA Pharmaceutical Co, Dr Marshall will continue as president of CIBA Chemical & Dye Co, and Donald Joseph will become president of CIBA Products Co.

PERSONALITIES IN THE NEWS

Gerstacker

Ritter

Lukman

Grether

Carl A Gerstacker, chairman of the board, The Dow Chemical Co, was re-elected president of the Synthetic Organic Chemical Manufacturers Association at its 40th annual meeting, held December 7 at the Roosevelt Hotel, New York, NY.

Others re-elected to office were *Chester M Brown*, president of Allied Chemical Corp as 1st Vice President of SOCMA; *Arthur P Kroeger*, assistant general manager of the Organic Chemicals Division of Monsanto Chemical Co, re-elected 2nd Vice President; and *Robert L Bateman*, manager of marketing services of Union Carbide Chemicals Co, Union Carbide Corp, re-elected treasurer.

John M Fasoli, associate director of purchases of American Cyanamid Co, and *Thomas F Willers*, executive vice president of Hooker Chemical Corp, were elected new members of the board of governors, Class of 1964.

Continuing as Members of the board of governors, Class of 1962, will be *Paul Mayfield*, vice president of Hercules Powder Co, and *Harold G Shelton*, executive vice president—operations, General Aniline and Film Corp; also, *Louis F Loutrel Jr*, vice president of sales, Maumee Chemical Co, and *Carl S Oldach*, assistant general manager of the Organic Chemicals Department of E I duPont de Nemours & Co, Inc, will continue as members of the board of governors, Class of 1963.

Elvin H Killheffer and *August Merz*, past presidents of the Synthetic Organic Chemical Manufacutrers Association, were re-elected honorary members of the board of governors, Class of 1962.

●

Ultra Chemical Works, Inc, a subsidiary of Witco Chemical Company, Inc, has announced the appointment of *Robert E Ritter* as sales manager of its Industrial Chemicals Division. In his new position, Mr Ritter is responsible for the sales and distribution of Ultra's detergent chemicals to manufacturers of industrial and chemical specialty products.

Formerly eastern district sales manager of Ultra's Industrial Chemicals Division, Mr Ritter joined Ultra in 1955.

●

The board of directors and the officers of Wica Chemicals, Inc, recently announced the election of *John Charles Lukman* to the office of vice president.

As director of the entire Wica technical program, Mr Lukman will head up an extension of the customer program for the textile, paper and paint industries and will direct new product developments in polymer emulsions, condensation products and specialty chemicals.

According to Lukman, plans for additional emphasis on applications and polymer development departments will assist in strengthening the customer service group. His earlier business associations include Borden Chemical, Celanese and Shawinigan Resins.

●

Werner Grether has joined Ciba Co, Inc as a dye chemist specializing in wool and synthetic fibers.

Grether has been assigned to Ciba's central dye laboratories at Fair Lawn, NJ, but will be available for technical assistance to the various Ciba district laboratories throughout the United States.

Grether has had extensive experience in practical dye application work with several large European firms. He was also president of the Swiss Association of Dyeing Technicians.

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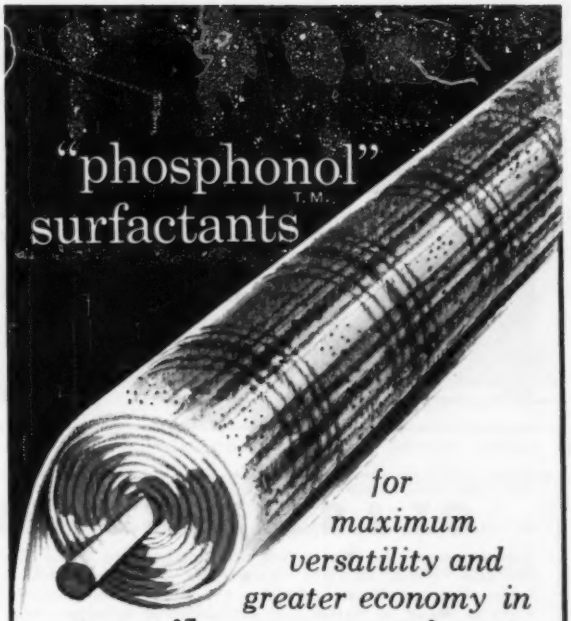

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WANTED: HEAD DYER for dyehouse to be established within the next few months in a New England Spinning Mill. Possible experience required in Worsted and synthetic dyeing of tops, skeins and packages. Send written offers. Write Box No. 267

WANTED: CHEMIST with thorough knowledge of textile specialty chemicals and analytical procedures. Excellent opportunity with young progressing company in metropolitan area. Replies held in strictest confidence. Write Box No. 268

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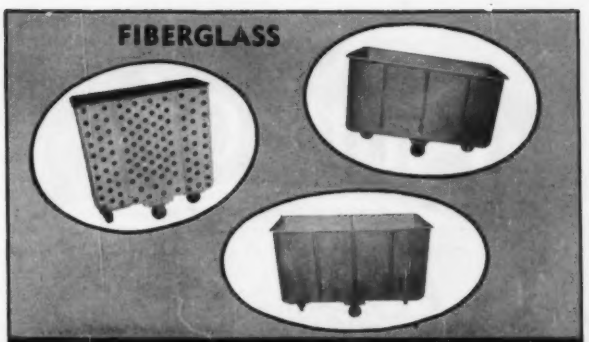

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Mrs Mary Griess Ard

Mrs Ard was the last surviving child of Johann Peter Griess, discoverer of the diazo reaction, and the first azo dyes. These azo dyes, as a class, are as valuable to world industrial economy today as they have been since the 1880's. This is due to the utility of the reactions which have made possible dyestuffs of beautiful shades and valuable properties for any dyeable material. A large amount of the organic pigments used for opaque coloring of surfaces are azo compounds. Dr Griess was born and educated in Germany; but married an English woman, and lived and worked in England until his death.

The lady died quite unexpectedly on March 22, 1961 at eighty-two years of age, and was buried with her husband in Ross Bay Cemetery, Victoria, British Columbia. He had died in 1921. She came to Canada in 1909 to teach piano in St Alban's College for Girls, Prince Albert, Saskatchewan. Here she met and married Mr Ard, who worked for the Canadian Government. Later, they moved to Victoria where she spent the remaining years of her life, except for a trip to Italy and France in 1931. She was called "Dolly" by her friends, and her life-long liking for small animals and flowers helped dispell the loneliness that she must, at times, have felt. While three of the four Griess children married, none had children. Mrs Ard's death brings to an end all descendants of Peter Griess.

ADR ABSTRACTS

Polyurethane Foam in Clothing

Weinstock, L, *Man-made Textiles* 38, #444, 46-50; #445, 39-41; #446, 50-1 (1961)

In Part I the author explains the properties and general characteristics of foam-backed fabrics and their advantages to the consumer and the trade.

Urethane foams are made by reacting hydroxyl-terminated resins, called "polyols" (castor oil, polyethylene glycol, polyesters) with a diisocyanate and water in presence of a catalyst. The reactions involved are described by the author. The foam is produced in the form of large "slabs", which are sliced into sheets of any desired thickness (one-sixteenth of an inch, or thicker).

Today in the US the polyether-type foams are used primarily as a cushioning material, and have found widespread use in the furniture and automotive trades, where to a great extent they have replaced latex foam rubber, the author states. These foams have excellent resilience, quick recovery, and high stretch and elongation. They make an ideal, economical material for use in various bedding, cushioning and seating applications. These polyether foams are generally considered to be nonallergenic, have good resistance to most chemical compounds, oils and water, and clean easily.

The polyester foam formulations now available in the U S provide the apparel trade with a lightweight insulating material having a softness and drape unmatched, according to the author, by many of today's conventional textile lining materials, and with considerably less bulk. The foam is resistant to laundering and drycleaning solvents and has good dimensional stability. It is odorless, mildew- and fungus-resistant, and is generally nontoxic to the skin.

The advantages of the foam in clothing are described in great detail.

In Part 2 the author discusses the various basic processes used commercially for combining urethane foam to fabrics (quilting, adhesion and fusion lamination methods). He states that today the fusion-bonding process is the most widely used method, especially with knitted fabrics. It can bond only the polyester-type foam, however.

In Part 3 he offers some thoughts on the future of foams in the textile industry. The combination of woven stretch fabrics backed with urethane foam, particularly for sportswear, "holds promise as an inspiring style innovation", he says. Another interesting application for the foam is as insulation for all types of handwear (eg, gloves and mittens) designed to protect against both heat and cold. A layer of foam in work clothing will provide increased comfort and warmth in all outdoor activities.

•

The Accelerotor as a Test Machine for Felting Shrinkage

Stott, G L, *Textile Research J* 31, 977-80, Nov 1961

There has long existed a need for a test of felting shrinkage which would not only be rapid in operation and suitable for laboratory use, but the results of which would bear some relation to results obtained from domestic laundry machines.

Results of felting shrinkage tests on a number of worsted and woolen fabrics using a modified form of the AATCC Accelerotor abrasion tester reveal a significant relationship to shrinkage obtained in three different domestic washing machines. This, together with the rapidity with which these tests can be carried out, show that the modified Accelerotor could be useful as a laboratory-scale felting-shrinkage tester.

Preliminary investigations showed that while the Accelerotor, as supplied, gave promise as a shrinkage tester, it suffered from two disadvantages: 1) the sample under test tended to be caught either around the blade of the propeller or between it and a ferrule covering the drive shaft; 2) at the relatively low speed found necessary for this work the motor had not sufficient power to maintain constant speed under the fluctuating load.

A modified rotor was made, basically similar to the S-shaped propeller supplied, but in which the blades were curved away from the direction of rotation. The separate ferrule was replaced by a conical hub formed integrally with the blades. Not only did this modification largely eliminate capture of the sample by the rotor; it allowed the maximum speed to be increased from 1000 to 1500 rpm, and considerably reduced speed fluctuations. It was thus possible to continue the work using the original motor.

Cloth samples were cut to 100 mm squares with their sides at an angle of 45° to the warp and filling directions. The Accelerotor was fitted with a ribbed rubber lining. A soap solution consisting of 0.05% sodium oleate and 0.3% sodium metasilicate in deionized water gave good results. The test required only five minutes; to obtain the same amount of shrinkage, washing machines require from two to seven hours.

Further modifications of the Accelerotor are contemplated.

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***A side note to dyers and finishers with brightener-resin-catalyst problems: Peregal ST added to the resin bath (in range 0.15–0.30%, based on weight of total finish bath) slows down the exhaust rate and considerably reduces any tendency to "tail off" during extended padding operations.**

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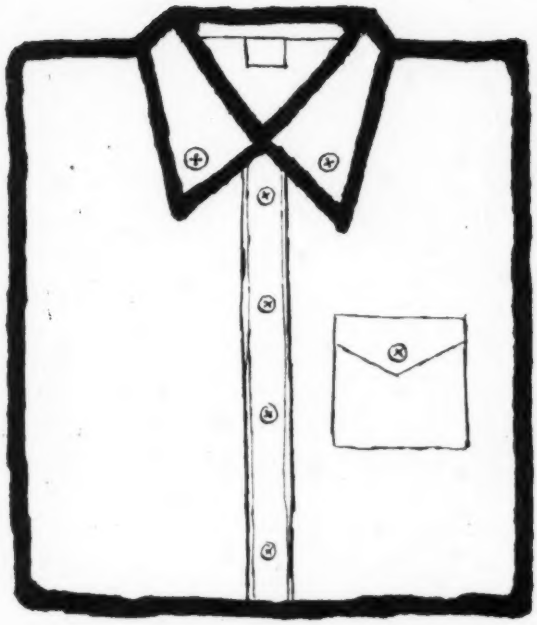

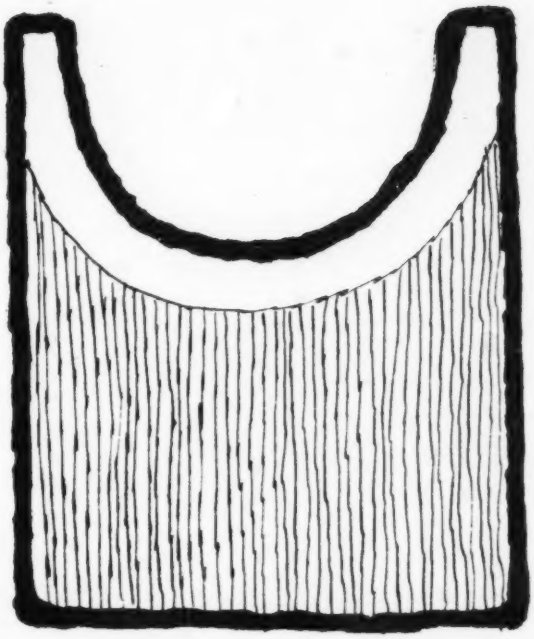

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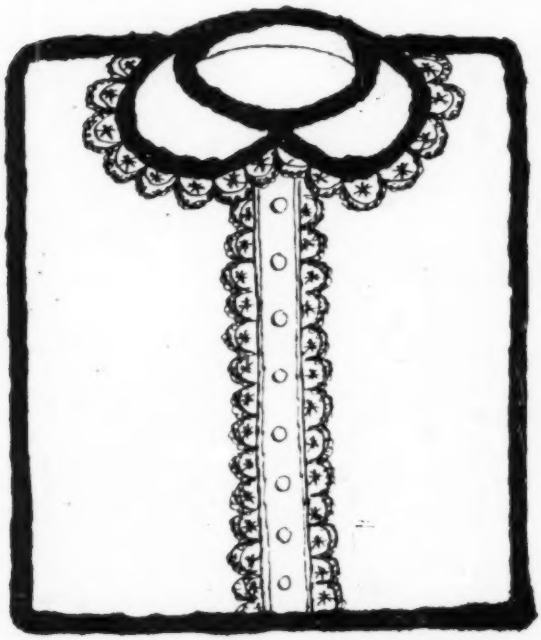

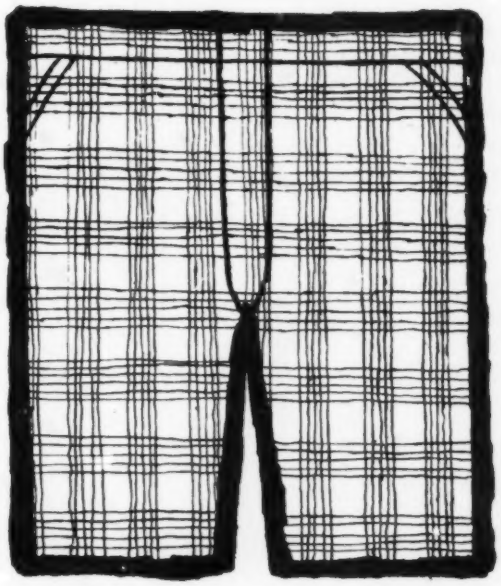

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